EDITORIAL

WHEN I arrive home in Sydney in a few days time, I expect to find a great deal more positive thinking about TV on the part of the general public, than was evident when I left Australia in March.

I am quite sure that many people are now actively considering the purchase of their TV sets, as the starting time for regular services draws near.

I wonder whether, as yet, any thought has been given to the aerial problem? Skyscrapers may have drastically altered the general skyline of big cities in USA, but nothing has affected the eneral view of the rooftops as much as the fungus of TV erials which has sprouted from every building

One thing, of course, is certain—everybody must use a od aerial to make sure of clear pictures. But I often onder whether some of the monstrous structures I have en can be justified on the grounds either of efficiency of beauty.

In both England and America the enormous number of ts in use has built up a huge aerial business, and bright ys have outbid each other in claims for their often fanstic designs.

The worst examples occur in areas where both the low d higher frequency are in use. It applies particularly England where the 40Mc channels are so freely used. their efforts to combine reception over an extremely de band channels, mechanical ingenuity has triumphed t only the birds, which perch on the rods so temptingly spayed, can view the result with any gratification.

To suggest there should be legislation to control aerial ection is dangerous, and I would not, at this stage, advocate ch a thing. But I do hope that some restraint can be ercised in the design of aerials for sale to the public, so t they will not become an eyesore by unnecessary comcation.

In areas where TV signals are strong, I have often seen loor aerials which give perfectly satisfactory results. In ier cases aerials just beneath the sills are perfectly OK. ly way out in the fringe areas do really high and comcated aerials seem necessary.

t seems to me that all concerned have a golden oppority to give sane guidance to buyers of sets, who are urally anxious to get the best results from them, so that best compromise can be reachbetween clear pictures, on the hand, and the whiskered wons, so often seen in other parts he world, on the other.

John Moyle

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RADIO TELEVISION & HOBBIES

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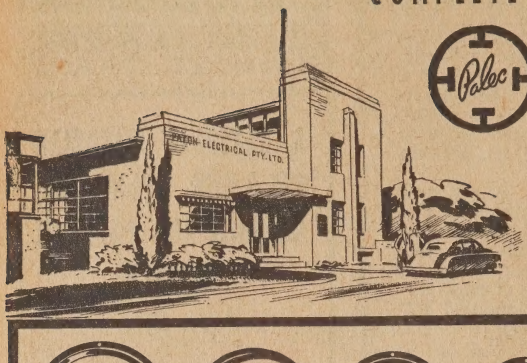
OUR COVER PICTURE

The manufacture and development of television picture tubes calls for a high degree of skill in many fields. Not the least is an understanding of glass working, as shown. When evacuated, the tubes have to withstand enormous atmospheric pressures, and internal strains left by faulty processing can render them unduly liable to dangerous implosion if bumped or scratched. (See page 4).

COMPLETE ELECTRICAL INSTRUMENTA



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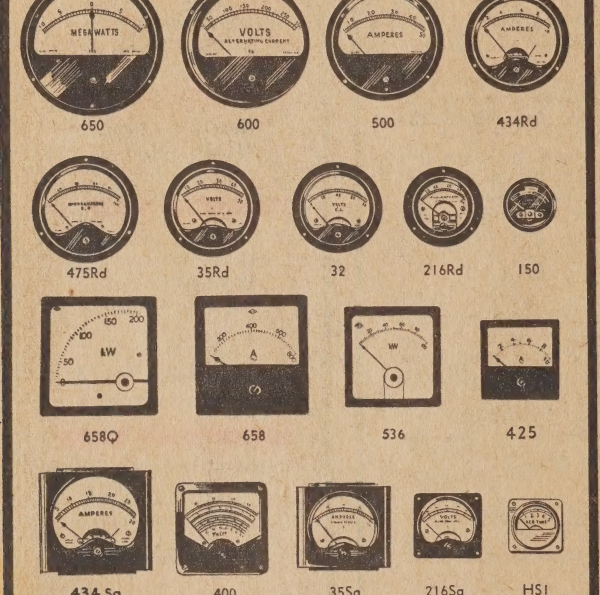

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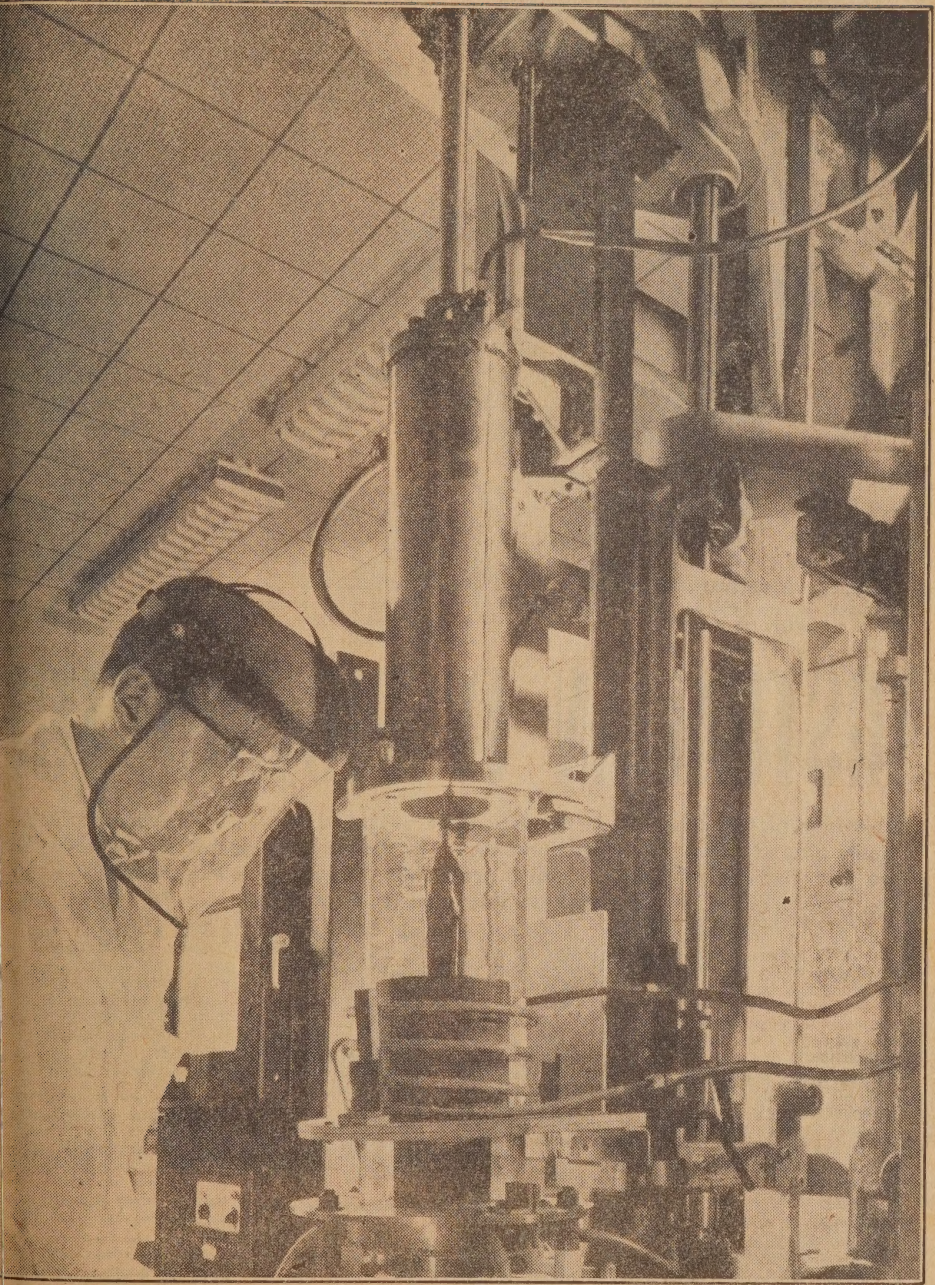
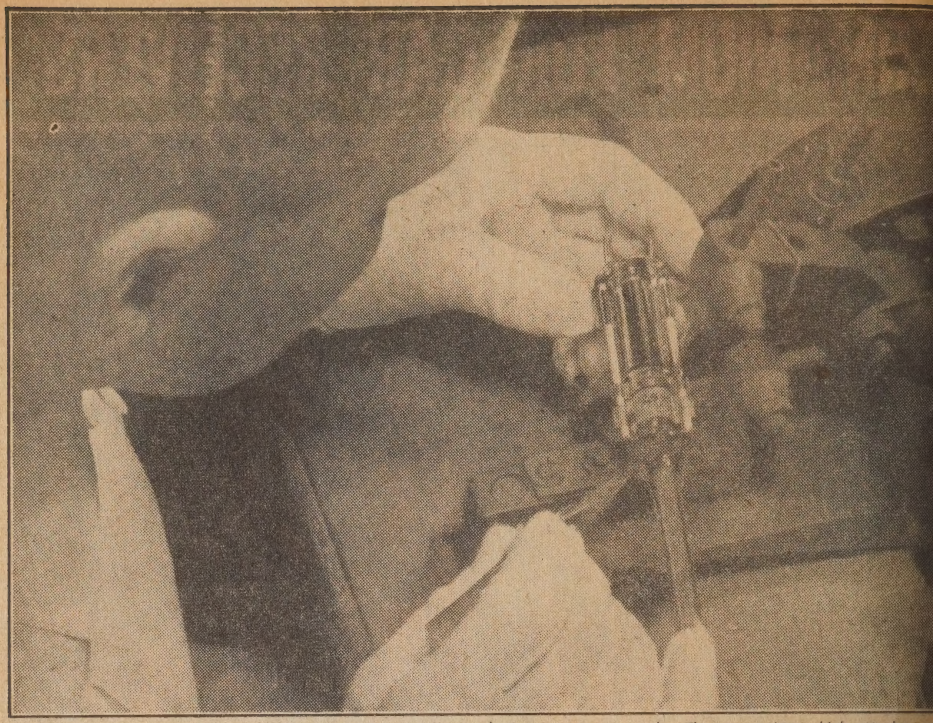
ERMANIUM FOR CAR RECEIVERS



in the Delco Radio Division semi-conductor physics laboratory studies the growth of a large crystal of germanium, which can e centre of the quartz housing. In five hours, the crystal grows to over 11 inches in length, an inch-and-a-half thick and is ollars. Cut into tiny wafers about three-tenths of an inch square, it becomes the heart of Delco Radio's new high power tran- transistors appear in the audio system of the new Delco Radio fitted to Chevrolet Corvette cars (See story on page 11).



Assembling the element structure for a typical Australian-made television picture tube. The spot welder which attaches ea rode to the supporting structure is electronically timed. Extending downwards from the structure is the tube through w air is ultimately exhausted.

AUSTRALIAN TV PICTURE TUB

Television picture tubes are in the news these days and Australian valve manufacture busily preparing for local mass production. By courtesy of Amalgamated Wireless Valv we were recently privileged to watch production of these intriguing devices and to ta pictures presented on these pages.

by Philip Watson

AT the time we made our inspection the AWV engineers emphasised that what we were seeing was only a "pilot" run; a production line on a small scale; more concerned with developing techniques, overcoming problems and establishing standards than with producing large quantities.

In a few weeks, probably by the time this appears in print, a new factory will be in operation.

The tubes we saw were 17in (diagonal) types, having aluminised screens and electrostatic focusing, the latest in picture tube techniques.

Commencing with the bulb, which has itself quite a story, the first operation is to coat the screen with the fluorescent material, which will eventually convert the electron stream into images of the Test match, the Melbourne Cup, or Australia's version of Diana Dors!

Extreme cleanliness is essential during the coating operation and all trace of foreign matter must be removed from the inside of the tubes. This is done by washing with a weak acid solution. The water from which it is mixed has to be filtered and purified to reduce the solid matter content to less than five parts per million!

The coating process is an extremely ingenious one and, although employing principles which are basically simple, calls for a high degree of skill.

The tube is stood upright (i.e., face down) and water poured into it to a depth of about three inches. In addition to being purified as already described, this water contains a gelling agent.

, Next is added a carefully quantity of "waterglass" in form. The gelling agent no work, causing the waterglass This mixture, being heavier t settles to the bottom and, on tact with the glass, adheres to

This is followed by the p actual screen material.

A carefully measured amo dry mixture is added to a purified water and while t is still in suspension, the liqu ed into the neck of the tube. for considerable skill, and t uses a funnel to disperse t evenly over the "cushion" o side.

Now the tube is left undi about 30 minutes. During t phosphor settles through the ion and into the gelled wa is this latter which ultimat and serves as a binder to h ticles of phosphor against the tube.

itially it is quite soft and the in a delicate state. Conse- he tube must be handled very during the next operation — the off process, during which the hion is removed.

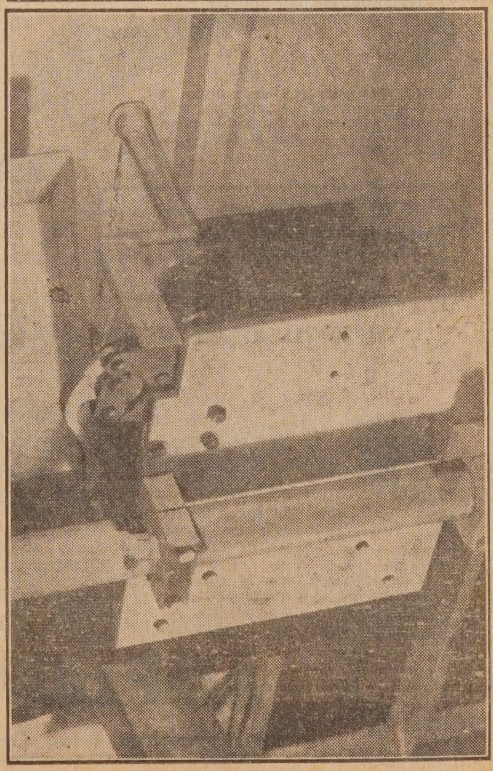
o delicate and tedious an opera- rust to human judgment, so a al device is employed to tilt very slowly until all the water off. The whole process takes minutes. When complete, the the tube is dried with a gentle of warm air. This "sets" the nd renders it much less prone uent damage.

e screen is by no means com- resent-day practice is to "alumi- a process which adds consider- ne brilliance of the picture with- ncrease in operating voltage. In tube much of the useful light by being reflected from the screen back into the tube. The ng process provides, in effect, a ehind the screen which directs forward again.

mirror is rather unique, be- nust be thick enough to reflect yet thin enough to permit the stream to pass freely through phosphor screen. It is made ising a quantity of aluminium aluminising") inside the tube positing a microscopically thin

Even distribution of the phosphor across the screen face is essential if a picture of uniform brilliance is to be obtained. The bulb is first filled with specially purified water, then the phosphor material in liquid suspension is slowly poured into it. The phosphor powder disperses through the water, then gradually settles on to the face of the tube, which is already covered by a soft layer of sodium silicate. For the operation, the tube is mounted on the platform, as shown below.

☆



e glass bulb is being coated internally along the sides k with a film of graphite which, in actual use, is con- to a source of very high voltage (the EHT supply). rator removes any surplus graphite with specially ed brushes, guided by preset indicator fingers.

he phosphor has settled (picture at top right), the on which the tube rests is tilted very slowly on its iven shaft. The water is gradually poured off, leaving the phosphor deposit on the face of the tube.

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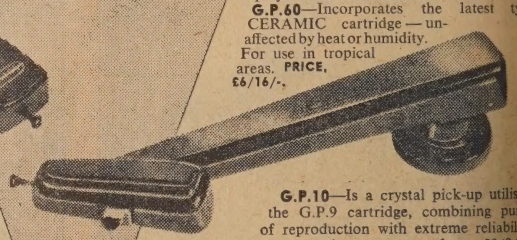

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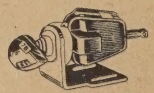

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is behind the phosphor screen. er, it is not sufficient to simply his on the screen itself. Due nite size of the phosphor par- surface is irregular and quite to make a mirror finish. This me by giving the rear of the coating of lacquer, just thick o fill in the "valleys" between and thus provide a smooth sur- the reflecting medium.

applied the lacquer — another lled operation, by the way — the screen is temporarily sus- nd another process initiated.

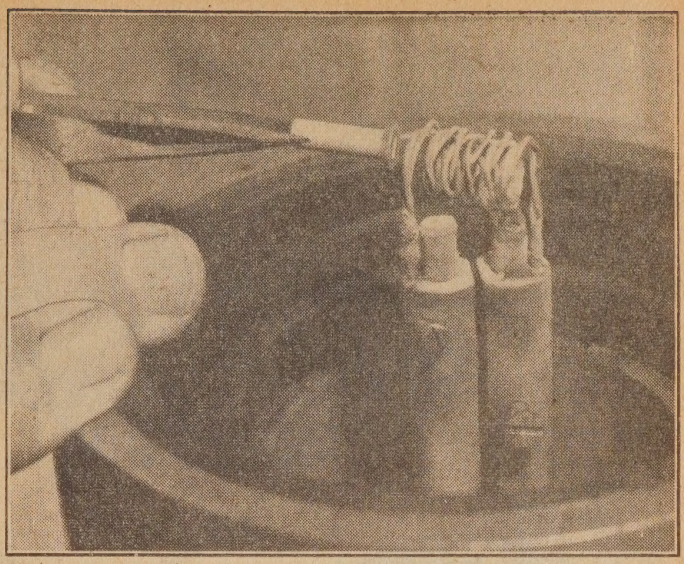
ITE COATING

to deposit a graphite coating tube, which forms part of the de. The other part of the final a conventional electrode on the ture. Metal "fingers" attached ter make contact with the graph- g. After the graphite is ap- coating is shaped to the re- e and pattern, using a jig with n pre-set arms.

ndary function of this coating m one plate of a capacitor, n conjunction with a conductive ting, as the other plate and the he dielectric. By earthing the ting the capacitance so formed across the EHT supply and final filter unit.

e return to the aluminising pro- small slug of aluminium is sup- a heating coil and the tube ver the top. It is temporarily and placed under vacuum, the oil is energised and the alumin- rised.

followed by a baking process, being heated to 400 degrees out two hours.

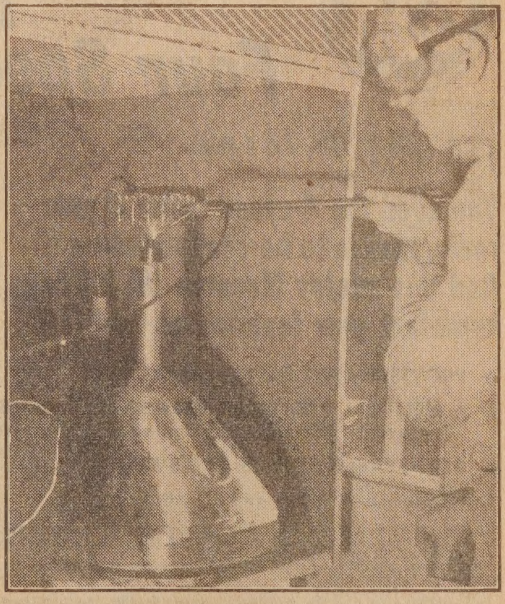


The picture tubes illustrated have a microscopically thin layer of metallic aluminium behind the phosphor and aluminium slug, shown here, is melted on to the coils of a hot filament. The bulb is pushed down over the filament, evacuated temporarily and the filament heated sufficiently to volatise the aluminium over the entire inner surface of the envelope.

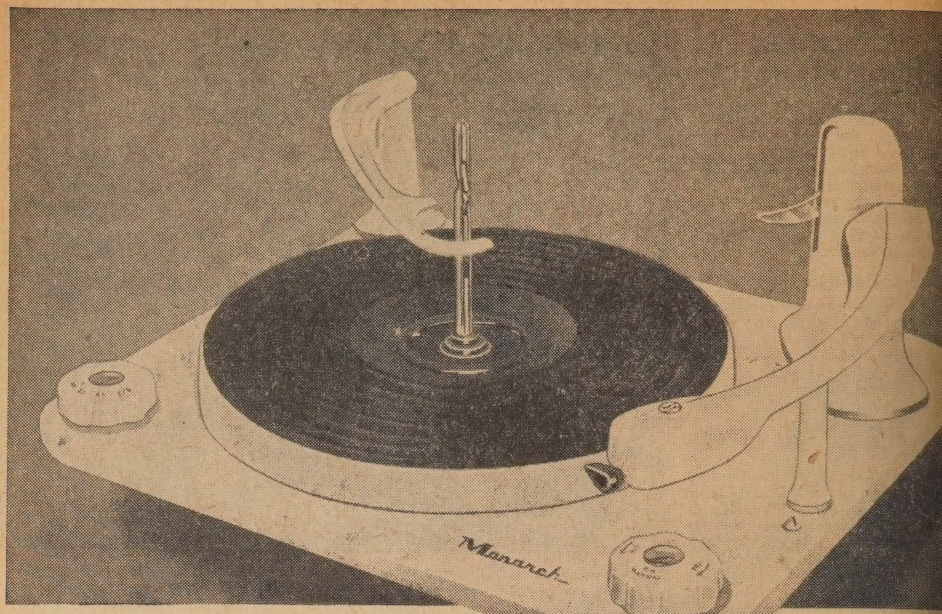
The baking has a dual purpose. It removes any water vapor which may still be present in the tube or screen and it also vaporises the lacquer coating underneath the aluminising screen. As a result there is no obstruction between the phosphor and aluminising screens, the latter being supported by a relatively few "high spots" of phosphor.

While all this processing of the glass

or final assembly, the prepared bulb is lowered over the de structure, as shown in the picture at the head of cle. Rotating gas flames sever the surplus glass skirt e the neck of the tube to the glass disc supporting ctrodes. The tube is then evacuated and the exhaust tube sealed off.



As a precaution against later breakdown due to microscopic particles within the tubes, it is treated as shown here with a very high voltage. Any particles of "lint" which may have lodged near vital parts of the structure are readily removed by the treatment. The Pip on the side of the bulb provides a connection for the EHT supply.



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3. **On/Off Control.**
   The on/off control also has the facility t records at will. A manual position on th trol enables the changer to be used as a player, if desired.
4. **Automatic Shut-Off.**
   When the record retaining arm is ov spindle, the pick-up will return to it position and the motor will switch off a last record has been played or rejected.
5. **Pick-up Arm.**
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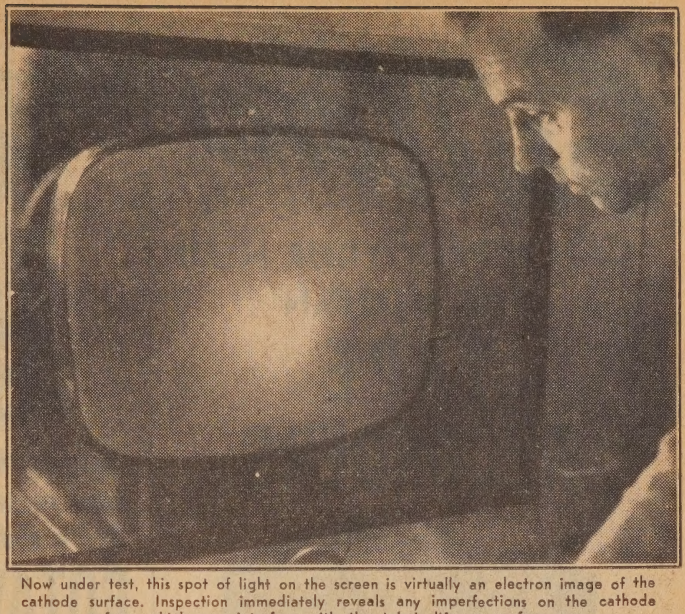
een in progress, another sec-
factory has been assembling
ucture.
chniques identical with those
ional valve manufacture — in-
cision jigs and tiny spot-wel-
"gun" is built up from punch-
arts and a glass stem. The
ies the wires which support
ts, plus the glass exhaust tube.
e is lowered over this struc-
wo accurately aligned, and a
ting gas flames directed on to
f the tube. In one operation
the surplus skirt and fuses
der to the stem.
on is the next step and the
ped out through the exhaust
e stem. While under vacuum,
sealing, the tube is again
400 degrees C, for one hour,
an RF heater heats the metal
00 degrees C, for 10 minutes.
release any gas contained
al.
is achieved by the simple ex-
heating the exhaust tube un-
ss becomes molten. It col-

e is the cathode itself. Only
tip of the cathode is coated
is the source of all the light
een on the screen throughout
he life of the tube.

der atmospheric pressure and
own seal as the molten glass
ards.
entional "getter" may then be
in the tube, combining with
traces of gas which may be

itting a base, the construction
e is virtually complete, but a
tests must be conducted to en-
it will function correctly in
and have a long and satisfac-
Many of these are electrical
ar to those conducted on ordi-
es. Others are peculiar to pic-

these is known rather color-
spot knocking"; the "spots" in
eing any microscopic particles
tube and which may lead to
breakdown. The "knocker"
voltage source touched on to
ins. It effectively destroys any
gn matter in short order.
ingenious test is to check the
r even overall emission. Any
s on the cathode suface would
indicate a possible restricted



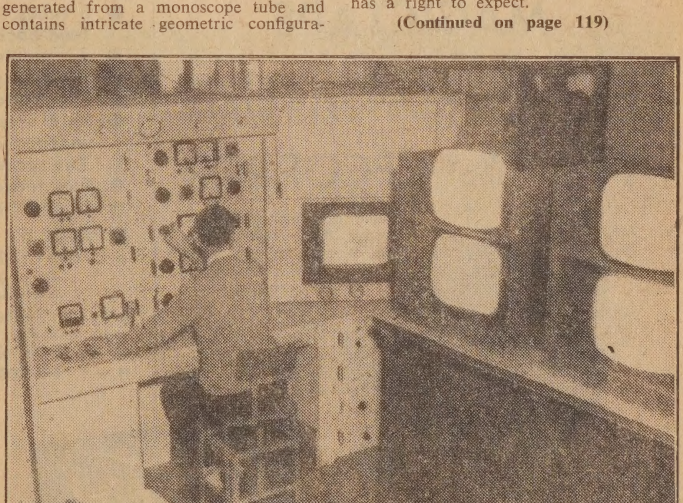
Now under test, this spot of light on the screen is virtually an electron image of the cathode surface. Inspection immediately reveals any imperfections on the cathode surface, which may interfere with the tube's life or performance.

life, but could also mar the picture. By selecting suitable operating conditions, the tube may be made into what is virtually an electron microscope, producing a much enlarged image of the cathode on the screen. Under these conditions accurate inspection is relatively easy.

Now the tube must be checked for screen brilliance, accurate and even focus and, in general, the ability to reproduce correctly a typical test pattern. This is generated from a monoscope tube and contains intricate geometric configurations designed to test the tube's resolving power far beyond that required in practice. This pattern is piped to all test points in the factory.

Finally, a percentage of production, selected at random, is diverted for life testing. Run continuously at a brilliance far in excess of that likely to be encountered in practice they provide a check that their counterparts in the field will, in fact, have a life which the purchaser has a right to expect.

(Continued on page 119)



A typical picture tube test set-up, where brilliance, focus, linearity &c are checked. The test signal is supplied from a monoscope test pattern generator which feeds all test positions in the factory. The tubes on the right are undergoing life test, with an unlocked raster pattern on the screen.

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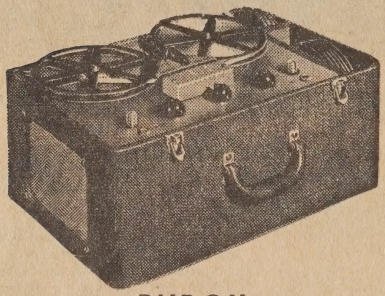

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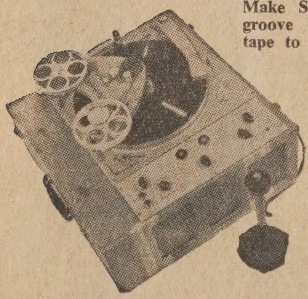

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W CAR SETS USE TRANSISTORS

since Bell Laboratories announced their first transistor eight years ago, electronic engin- have been intrigued by its possibilities in car radios. But while there has been much talk is direction through the years, no manufacturer made a positive move towards transistors until just recently.

By PEDR DAVIS

LER Corporation in America first. They announced an all- radio as standard equipment "Imperial". Since then, other rers have followed suit. Gene- rs have a hybrid set, using sistors and valves. American ave a similar unit and Ford ing both transistor and printed- dio sets in production cars on mental basis.

s, therefore, that the new-type s are here to stay.

cturers and independent gree that even the early model or sets have proved their over conventional units. The s are:—

more power with less distor-

rm-up period and no vibrator

imately one-twelfth current

operation instead of a high- power supply.

lighter sets with a consider- rice reduction in sight.

HIGH

present time, the production ransistors is high enough to t of their advantages. But the s keenly aware that, as soon of the semi-conductors ap- the present output of electron price will fall drastically.

t designs, a power transistor utput stage alone may mean f about twenty parts. Among important of these are the ube, power-output tube, power er and vibrator.

rid" sets (now in high-volume in America), a transistor re- vacuum tube in the receiver ge and also the power supply Another recent development " set design is the scheme of receiver tubes at 12 volts in- he usual 250 volts.

ich as these retail at the same he former all-tube models and ed to have 80% of the ad- f complete transistor sets.

o early as yet to say that the he familiar vacuum tube has though some claim that tran- ll eventually replace an esti- % of all tubes now used in -sided field of electronics. The hat transistor development is infancy and no one can accur- tell just what will be achieved

Early transistors were not suitable for automotive use because they could not produce the power output required. Considerable research was necessary before they could be adapted to this particular application.

Much time and money has already gone into research work on the transistor and the problems associated with "growing" the pure germanium crystals which are needed. Means have had to be explored, also, of making the best use of the transistor's inherent efficiency in amplifying with very little applied current.

SILICON TRANSISTORS

Several substances have been used experimentally in the formation of the transistors. At the present time, much development work is concentrated on developing silicon transistors, though production transistors are still made from a metal-like substance called Germanium.

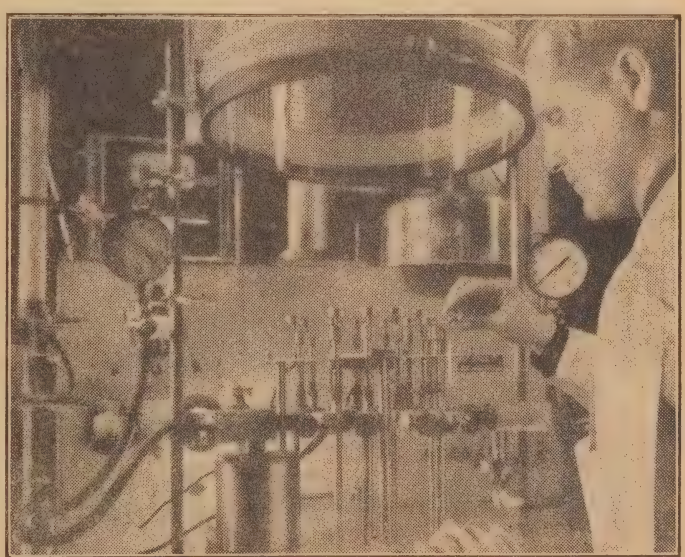
Germanium must be fantastically pure to operate efficiently and it is purified until there are approximately one-billion germanium atoms to one impurity atom. But then it is too pure, for transistor action requires minute amounts of a known type of "impurity". Consequently, one part of antimony is added to 10,000 parts of germanium.

PURIFYING PROCESS

The purifying process of germanium is most interesting. A graphic boat made of the transistor material takes some eight hours to move through the special zone-refining device. This zone refiner has a series of eight induction heating coils in its 12-foot length.

Once it is purified, it is ready for the "doping" and the "growing" processes. In these proceses an infinitesimal amount of antimony is added and the germanium atoms are arranged to provide avenues for the carrier of current, electrons and "holes".

To do this, a "seed" of the element in which atoms are perfectly arranged in a lattice-like structure is dipped into the molten germanium mixture. The seed is rotated slowly and imperceptibly withdrawn from this mixture. As



The new Delco high-power transistors are finished off in this machine, which evacuates the container and then fills it with a neutral gas before final sealing. Used in the audio system of a car radio, they produce more power output than valves, at only a fraction of the current drain.

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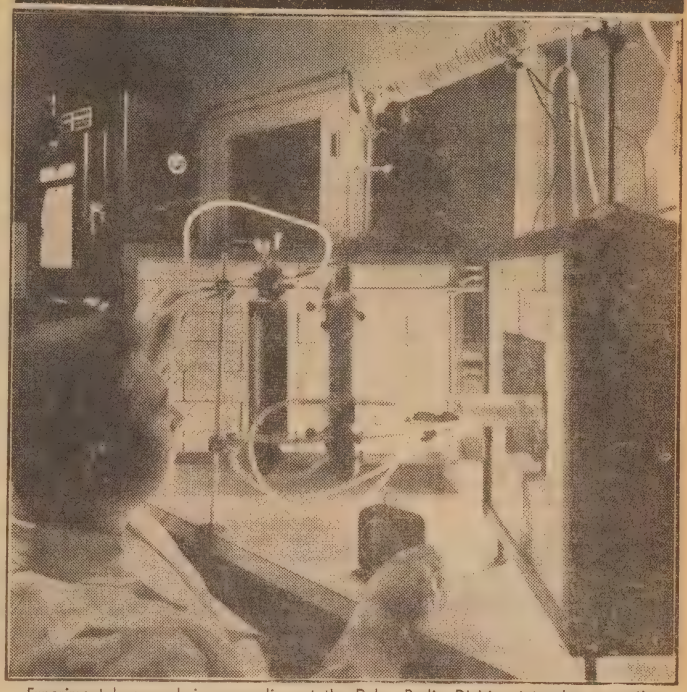
s withdrawn molten germanium
s to it and soldifies, growing a stick
germanium some 11in long and
t 1¼in in diameter. This takes
t five hours.
is single crystal stick is cut by
ond saws into thin slices. They
hen ground to an accurate "thin-
in an optical grinding machine.
this, the slices are diced into
e wafers by ganged diamond saws.
square wafer of "doped" ger-
um is the heart of the transistor
is about 3/10in square and one-
redth of an inch thick.

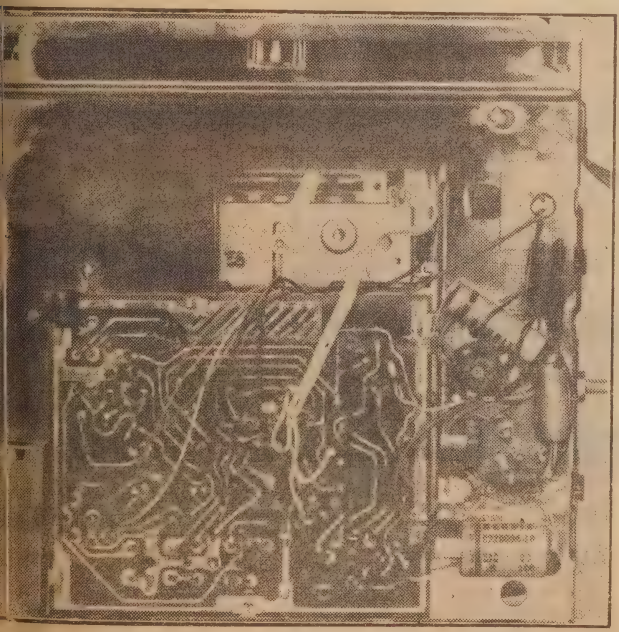
DE INTO WAFER

make this wafer into a transistor,
wafers of indium are alloyed to
side, in sandwich fashion.
e sandwich or transistor is mount-
n to a base which, in turn, is
d to a stainless steel cup. In a
l machine a vacuum pulls out
is cup such damaging atmospheric
onents as moisture. Then a neutral
s inserted and the closed cup is
etically sealed.
us a diminutive "power" transistor
de which will handle more power
he much larger vacuum tubes used
tomobile and household radios.
e life expectancy of transistors has
et been determined accurately and
physicists hesitate to say what it
be. They are confident, however,
ransistors will provide many more
of use than the more delicate
m tubes. They are more rugged,
le and trouble free.
nsistor type radios are particu-
adapted to use in automobiles.
from the advantage of size and
t, there is the advantage of cur-
rain. Present day tube radio sets
e a high tension supply of about

MAKING SILICON TRANSISTORS



Experimental research is proceeding at the Delco Radio Division into the properties and performance of silicon transistors, as distinct from germanium types. Here, minute impurities carried by a gas are being added to small pieces of silicon visible in the glass tube.



nderneath view of a 1956 model Bendix receiver using part printed circuitry. ombination of transistors and printed circuits promise smaller and more efficient receivers than ever before.

250 volts and draw about 3.6 amps from a 12-volt battery.

Transistor sets offering the same or more power operate directly at 12 volts, which is the new standard size for car batteries and draw about 0.2 amps, or as much as a pilot bulb.

Thus a transistor radio might run continuously for 140 hours on a 12-volt battery without recharging while a conventional set will perform for only about 10 hours under similar conditions.

This point is more important than it may seem. There is a growing tendency for designers to build cars without cranking handles, on the principle that modern motorists do not expect to start the car any way other than electrically.

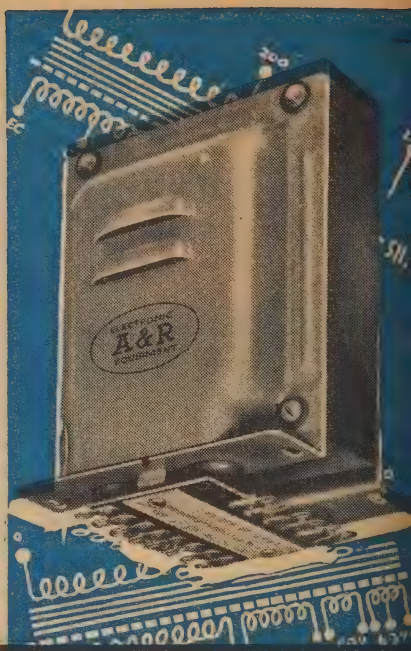
FLAT BATTERY

The car battery is subjected to enough strain as it is. If the radio is inadvertently left on overnight—a not infrequent occurrence—the chances are that the battery will not turn the engine over next morning.

Some cars get over this hazard by wiring the radio direct to the ignition key. This is most unsatisfactory, however, as it means that the key must be turned if the radio is to play while the car is parked. Damaged distributor points will result if the engine is not running. Thus the transistor's low current requirement offers an additional advantage to motorists, since two or three hours playing would not norm-

(Continued on page 15)

THE NEW A & R POWER TRANSFORMER



The latest in its field! Built to a high standard, yet reasonably priced, this NEW range of Power Transformers has been carefully designed to conform with the existing high quality of other A. & R. Products.

Designed for use in amplifier and similar power supply equipment, these transformers are produced on the latest coil winding machines, in conjunction with new manufacturing techniques, and only tested and approved raw materials are used in their construction.

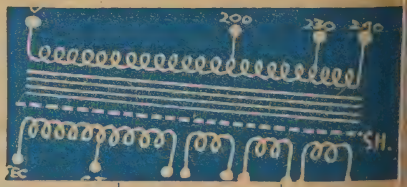
As illustrated, all types are mounted in attractive vertical pressed steel covers, finished in A. & R.'s standard silver grey. Leads are terminated on clearly designated terminal boards.

Obtainable NOW from all A. & R. Distributors! Our Distributors will be pleased to supply data sheets detailing the A. & R. Standard range.

TYPE NO.	D.C. MA	PRIMARY VOLTS	SECONDARY VOLTS	FILAMENTS
1763	100	200 — 230 — 240	300 — CT — 300	
1764	,,	,, ,, ,,	325 — CT — 325	
1765	,,	,, ,, ,,	385 — CT — 385	All in this Section
1766	125	,, ,, ,,	285 — CT — 285	
1767	,,	,, ,, ,,	300 — CT — 300	5v—2A; 2 x 6.3v—2A.
1768	,,	,, ,, ,,	325 — CT — 325	
1769	,,	,, ,, ,,	350 — CT — 350	
1770	,,	,, ,, ,,	385 — CT — 385	
1771	150	200 — 230 — 240	285 — CT — 285	5v—3A; 6.3v—2A; 6.3v—CT—2A.
1772	,,	,, ,, ,,	325 — CT — 325	ditto
1773	,,	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1774	,,	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—CT—3A; 2.5v—5A.
1775	,,	,, ,, ,,	385 — CT — 385	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1776	175	200 — 230 — 240	285 — CT — 285	
1777	,,	,, ,, ,,	325 — CT — 325	
1778	,,	,, ,, ,,	350 — CT — 350	All in this Section
1779	,,	,, ,, ,,	385 — CT — 385	
1780	200	,, ,, ,,	350 — CT — 350	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1781	200	,, ,, ,,	400 — CT — 400	
1782	200	,, ,, ,,	450 — CT — 450	
1400	250	200—220—230—240	565, 500, 425 A side	2 x 6.3v—3A; 2 x 2.5v—3A; 5v—3A
1371	300	,, ,, ,, ,,	1000, 850, 750, 600, 500 A side	— — —

Types 1763 to 1782 Vertical Mountings; Type 1400 Horizontal; Type 1371 Vertical with Top Term Board.

ALL TYPES TERMINATED AT LUGGED TERMINAL BOARDS.



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N.S.W
United Radio Pty. Ltd., 175 Phillip St., Homecrafts Pty. Ltd., 100 Clarence St.

CAR SETS USE TRANSISTORS

(Continued from page 13)

sufficient to take the kick out a poorly charged battery.

Chrysler set in the "Imperial", Philco, has been described as t completely tubeless car radio uses only 10 pc of the current of sets, and approximately one transistors replace all vacuum

from the technical advance the fields of transistors, Ford's so pioneered the way to con- progress with printed-circuit os.

TESTS

Bendix-built units were exten- ested in the field for two years he new system was standardised. sets deviate from the conven- iring method by having elec- ircuits "printed" on the base y a combined photographic and tic process. The implications method are as far reaching as sistor.

board normally used is com- XXXP phenolic with a lamin- pper surface on which the track is photographically reproduced. hotography, the board is etched ve all copper not covered by the phic pattern. The resulting track, bonded to the phenolic the printed circuit board. Many aterials are in common use for on of printed circuit boards.

wo in the production of a com- inted circuit assembly is the die of the boards. Initial cost of -hole piercing die is high, but nendous quantities involved, as the exactness of pierce locations for possible machine component , render this method of hole in- more economical on a per-board an conventional template drill-

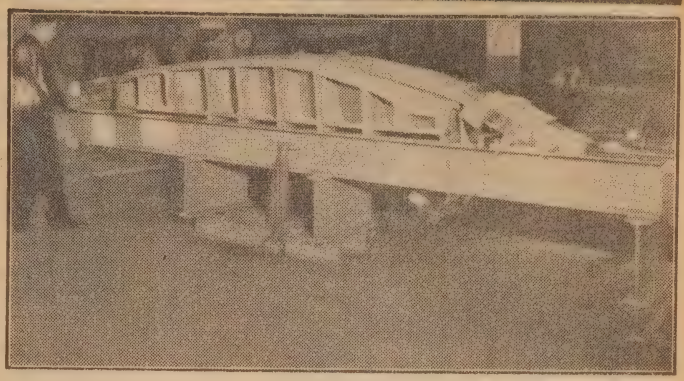
AL ASSEMBLY

bly of components to the boards manually. Operators are seated conventional "push" assembly l boards are passed from posi- position as the components are in predetermined hole locations. rds are reversed on the track at ervals, in order to permit proper of the leads to follow the print- r pattern, and to permit manual of excess lead length.

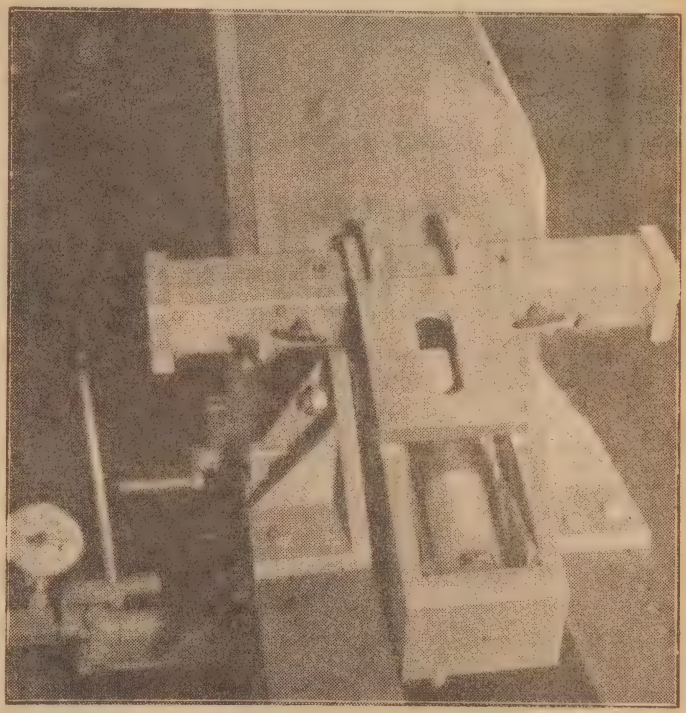
pper track side of the board is yed at approximately a 45 de- le after assembly and prior to ering. Angle spray prevents or netration of the flux into IF ectrolytics, and similar parts. oard is next immersed, copper wn, in molten bar solder, which ained at approximately 475 de- d are then coated with lacquer humidity.

of the lacquer requires only , during which time the board on a flat belt conveyor from ier booth to the point at which mbled to the metal chassis pan. done by means of clips which ally inserted through the board pan in such fashion as to pro-

STRETCHING WINGS TO SHAPE



By using gauge-equipment machinery fitted with two 20-ton hydraulic rams, Scottish Aviation, at Prestwick Airport, Scotland, are now able to shape metal panels for aircraft wings and fuselage in one-hundredth of the time previously needed to do the job by hand-beating methods. The complete job now takes 20 minutes to complete, against four days by hand. The picture above shows a metal panel being stretched over a former, and (below) one of the 20-ton hydraulic jaws which grip the metal.



vide adequate grounding at four points. Cross connection between the chassis components and the printed circuit board is accomplished by manual insertion and soldering of component leads to eyelets in the printed circuit board.

It is interesting to note that the uniformly high quality, in terms of board performance and appearance, of the printed circuit boards produced by the method described have led to the discontinuance of individual board checking before assembly into the set.

Apart from the saving in cost, a two-year experiment jointly carried out by Bendix and Motorola has shown that subsequent faults which develop as a result of the printed circuit are microscopic, compared to those found with conventionally-wired units.

A little miss gets quite a kick out of pressing the bu
which will produce a sixpenny sweet. Apparently
likes the idea, too!

box the lever returned to its
position and closed the valve.

No doubt this was a very p
gadget (Hero "copped the lot"),
probably foolproof, too, not b
of its mechanism but because
position in the Temple, where
be hardly the thing to be caugh
the lever down with a piece
or whatever they had in tho
Whether anyone used fake c
slugs of tin, history does not re

Although Hero's gadget wa
crude, it employed a principle s
in present day machines,
operating a lever with a coin.

Hero's invention did not
usher in an era of automatic sel
no more is heard of the idea
very early 19th century or ther

The tendency of the human
want to do illegal things was ca
on by an English bookseller a
lisher Richard Carlile in 182
devised a machine for selling
literature on the assumption
Government would find it hard
to identify the seller.

This machine looked like a cl
the titles of the books written o
The insertion of a coin in a
leased a carrier which served
appropriate naughty book.

ERA OF PUSH-BUTTON SHOPPI

As the "push button" era advances, more and more workers are being replaced by machi which carry out all manner of work, previously done by human labor. This is happenin shops as well as factories.

by Calvin Walters

IN last month's article we dealt with certain aspects of the much talked about "automation".

This month I propose to outline another avenue, where automatic machines are making remarkable progress. I refer to the selling field.

Automatic merchandising of goods is something which has been going on for many years in a limited manner. The last few years, however, have brought into being some very remarkable machines, and automatic merchandising has received a tremendous stimulus thereby.

VENDING MACHINES

In factories we find machines which do our work for us. Outside the factories we have machines which dispense merchandise without the aid of a salesman or salesgirl.

How far this can go without a severe impact on our economics is a matter of concern to everyone today.

The idea of automatic merchandising is not at all new. We have had penny-in-the-slot machines for many many years, dispensing chocolates, chewing gum, and the like.

The first recorded selling machine was invented in 219 BC by that smart Greek chappie Hero Castebus. He thought up a very profitable idea of selling holy water to people who worshipped in the Greek Temples.

The apparatus consisted of a tube and a rough sort of valve. When a coin was dropped through a slot it fell on to a horizontal lever which tipped over with the weight of the coin. This tipping action opened a valve which released a quantity of water. When the coin fell from the lever into a money

tunately for the inventor, his i
the law were in error and his p
tion put an end to the machine's

About this time there appea
English pubs, machines for sel
bacco. These were jars or box
a slotted hinged lid. The insertio
coin permitted the lid to be ope
that the operator could take the
out of the box and fill his pipe
fortunately there was nothing exc
honesty of the operator or the v
of the publican to prevent the c
emptying the container at o
swoop and, as neither of these re
were sufficient, the gadget fell i
discard.

CHEWING GUM

From then on various machin
into being from time to time bu
not until 1888 that a better
machine was evolved. This sold
Fruiti" chewing gum for a Mr.
Adams on the platforms of New
elevated railway.

Then came postage stamp

, post-card machines and others
beverages. The latter were first
rance from machines which dis-
ine, beer, cider and so on. This
890.
5 The Automatic Drink Mach-
pany of New York installed
for selling cider, lemonade,
d other harmless drinks. Least-
y were harmless in themselves
edly unhygienic in the matter
iness and the lack of refriger-
is brought about the demise of
ines.
f the greatest problems with
e early manufacturers of auto-
achines had to contend was the
of the machines to dispense
a variety of prices. They were
in machines with goods at a
time.

ANDS OF MACHINES

e this disadvantage the auto-
achine industry made tremen-
dway and at the beginning of
War II there were, in America
out 127,000 cigarette machines,
candy machines, 32,000 drink
and more than half a million
selling nuts, gum and other
nery.
g the war, industry found that
good idea to have automatic
installed in factories alongside
hines, so that workers could
hemselves during the long hours

1945 many devices were thought
vercome the difficulty of a cus-
t having the right change to put
machine.
stores, which have automatic
as part of their equipment
ls handing out change at coun-
wever, this gets away from the
completely automatic selling and
are now available which con-
ns of large denomination into
ions of smaller coins.
der to avoid the possibility of
ithout experience in the nicety
ss ethics getting change to spend
position firm or ringing up bets
phone, these machines are
in such a way that the customer
ke a purchase in order to get

AUTOMATIC!

was a fellow in Memphis, US.
sed a thing called a Keedoozle
me the change problem. He had
like a gun which he handed to
tomer who came into his store.
was provided with a roll of
ere was also a plate with slots
ing the item which the customer
o buy. By inserting the tip of
n the appropriate slot and pull-
rigger, the paper tape was suit-
orated.
by going through the slots and
gun, the paper finished up like
roll. This was taken to the
nd placed in a machine which
matic impulse orders to the
m and totalled up the amount
der at the same time.
quired goods came down a
l were picked up by the cus-
y a bit of fast working the
ould say ta-ta to the customer
w seconds after the last item
ered.
n well imagine the consterna-

tion of both customer and cashier when, because of oscillation and "motor-boating" in the electronic control circuit, bags of sugar, flour and other goods came down the shute at the rate of bags and bags per second.

A parking station in Chicago operates without human attendants in the following manner:

There are sets of twin gates like those used at railway level-crossings. One gate is across the entrance and the other across the exit. Near the entrance gate, in a convenient spot on the driver's side, a coin slot and control box is located. The driver places half the parking fee in the slot and the control box opens the entrance gate. When the driver wants to get out he places the other half of the parking fee in the slot and control and the exit gate opens and lets him out.

One parking company has customers who park their vehicles on a monthly basis. At the beginning of the month the customer buys a card which has a metallic content. When the customer wishes to enter the parking station he inserts the card in a slot. On withdrawal from the slot a photo-electric cell operates a release mechanism which opens the gate. The metallic content of the card is changed for each month and the operating mechanism is adjusted to suit so that only the card for that particular month will open the gates.

The two ideas above, to some extent, eliminate the troublesome change factor but the ideal system is for a machine to be a fully self-contained, automatic store, without sales people, and which will sell, deliver and give change.

ACCEPTS ALL COINS

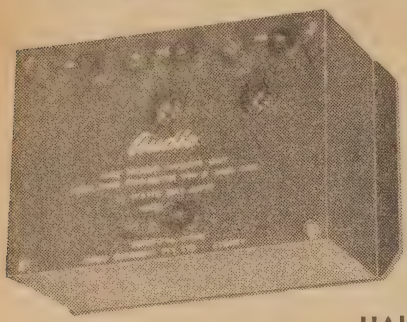
Developments to this end have brought about a mechanism which accepts, in American coinage at least, pennies, nickels, dimes and quarters in any sequence and any combination. It will deal with any amount up to 4 dollars 95 cents in any combination of coins and give the correct change. It will also handle odd amounts and also reject "crook" coins and slugs. Up to the present time no machine has been devised to handle paper money in this way.

So imbued are people becoming to the push-button idea that it has been found that, even if a machine will deliver the goods merely by pushing a coin

Another, somewhat older miss faces up to a full-scale automatic food vending machine in New York. Her name? Jane Withers!

Audio

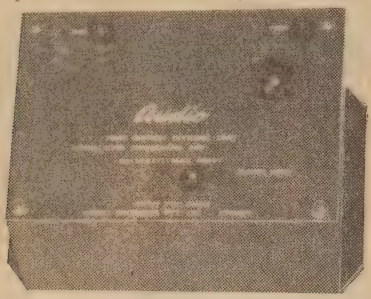
LOUD SPEAKER DIVIDING UN



Devices for dividing the bass and treble between loudspeakers at low impedance, thus eliminating intermodulation distortion between treble and bass, and permitting the most suitable mounting and placing of each speaker.

HALF SECTION TYPES

H3W. ½ section 3-way dividing unit, for 7-16 ohms with V.C.'s for middle and treble units. Cross-over frequencies 800 and 5000 c/s. Maximum input 30 watts. .. .. **Price £19/12/6**



HW8. ½ section 2-way dividing unit for 7-16 ohms with 1 volume control for treble speaker cross-over frequency 800 c/s. Maximum input 30 watt. .. .. **Price £17/12/-**

The attenuation with these units is about 12 db per octave from the main crossover frequency.

The loudspeakers should be of similar sensitivity.

The bass speaker should be as large as possible.

The middle speaker should be 8 in.—10 in. diameter.

The treble unit should be not more than 5 in.—8 in. diameter, or a small, hornloaded pressure unit could be used. A volume control is fitted across the tweeter terminals to reduce HF output where necessary, and to cope with scratch from old records. A separate volume control is fitted across the middle speaker to reduce stridency where it occurs in the region of 3000 to 5000 c/s, and also to improve realism when listening at low volume levels.

The crossover at 800 c/s is satisfactory with large reflex enclosures and normal cone type loudspeakers.

PHASING: With a ½ section crossover network it is important that the bass and middle speakers are connected up in phase. This can be checked by reversing the leads to one of the speakers. If the speakers are out of phase there will be a loss of output around the region of the crossover frequency. The phasing of the tweeter is unimportant.

The connections to the input terminals of a crossover network have no bearing on the question of phase; reversing the input leads makes no difference to results.

TWO SPEAKERS: Any of these 3-way crossover units can be used as a 2-way ½ section network by ignoring the treble terminals.

H32. ½ section 3-way dividing unit, 7-16 ohms only, with 2 as above. Crossover frequencies 800 and 5000 c/s, fitte 2-way/3-way switch which brings into circuit an ad inductance in series with the Middle Loudspeaker.

Price £

QUARTER SECTION TYPES

Maximum input 30 watts

QW1

Cross over .. .. 1000 c/s
Impedance .. .. 7-16 ohms
Price £9/16/10

QW3

Cross over .. .. 3000 c
Impedance .. .. 7-16 ohm
Price £8/13/

The two loudspeakers should be fitted with magnets of similar flux d
The treble unit may be the same size as, or preferably smaller tha
bass unit.

The total impedance remains the same as a single speaker. Two l
speakers give a load of 15 ohms. In view of the fact that the impe
tends to rise at frequencies above 1,000 c/s, it is quite satisfactory t
a nominal 10 ohm treble unit with a 15-ohm bass speaker.

The attenuation is at the rate of about 6 db per octave.

The crossover at 3000 c/s is intended for use with a small treble
such as a small cone speaker. Ribbon speaker or a small horn-
pressure unit, where it is necessary to limit the input of the lowe
quencies to avoid overloading. In such cases it is also necessary to
the range of the bass speaker in order to maintain full output
region between 1000 and 3000 c/s, where the acoustic efficiency of
units begins to fall off.

PHASING: With a ¼ section network and a crossover at 1000 c/
treble speaker should be placed 3in or 4in behind the frontal
of the bass speaker. With a crossover at 500 c/s the distance shou
increased to 6 in. or 8 in. At 3000 c/s the wavelengths are so
that the phase effects can be ignored.

Fidelity AE Audio Engineers PTY LTD

422-424 KENT ST., SYDNEY. PHONE B

VICTORIA Simon Gray Pty. Ltd. SOUTH AUSTRALIA L. & Co. WEST AUSTRALIA Athol M. Hill.

slot and waiting, it is still advisable some sort of a knob on the face satisfy the human urge to push something.

manufacturer found that because b was provided on his machines, stomer would fool around with n container into which the coin before pushing in. This caused because, while the customer t see anything happening, he he was losing his "dough" and rather rough on the machine. was overcome by placing a on the front with the direction, on the knob after inserting coin '. The knob did nothing at all satisfy the press button-pull knob

one who has operated one of nonstrosities which fill the air of milk bars with violent waves of s sound on the insertion of a will appreciate the general idea an automatic vending machine I refer, of course, to the juke-

BOXES

insertion of a coin into a slot onding to the name of a record rting a coin and pressing a utton e the title, sets in motion a train nts. The motor is switched on, a arm grabs a record, places it turntable and the pick-up drops he record.

gine the record, instead of drop- on the turntable, falling out a to be received by the customer u have some idea of the matter. ad of a lot of records with a of titles you have a lot of goods ariety of prices.

vast has the industry become in a that machines are now avail- automatically serve a tremendous of goods, among which are the ng:

, aspirin, cakes, books, combs, beverages of all kinds, fuel oil, hosiery, raincoats, greeting cards, al, cigarettes, milk, newspapers, m, pencils, sandwiches, stamps, azor blades, perfume, hot coffee, othbrush kits, soap, doughnuts, sweets, postcards, potato chips, foods, cigars, and so on.

there are service machines for shoes, dry cleaning, ironing, mas- long with parcel lockers, type- telescopes, scales, voice record- ashing machines, photographs, driers and many others.

INSURANCE

companies are making food o special shapes to meet the de- of the machines.

ng the unique uses of automatic s are those installed on railway s and other traffic terminals for insurance. A coin in the slot de- policy for a certain amount all and sealed.

are machines which sprays one rfume. These are usually located re lobbies and waiting rooms.

airline company which operates ce necessitating flying at great has installed machines to give of oxygen to help overcome air

machine has a rubber tube con- to an oxygen tank inside the . The other end connects to a which the passenger places over his mouth and nose. Inserting a coin in the device gives a whiff of oxygen. The funnel is made of paper and is thrown away after use so that good sanitation is assured.

On the Continent of Europe automatic vending is a flourishing business. Some stores have show windows displaying certain goods. The "windows" are really gigantic vending machines which are mounted on a pivot. At night, after the store is closed, the machines are turned to face the street with an array of slots for coin insertion to purchase the goods previously on display. This keeps the store in business 24 hours a day.

The vast changes which are taking place in the design of machines is tending to make them capable of carrying out all the activities and functions of a retail store but without the sales-people. They can deliver an ever widening variety of goods at varying prices. Machines for serving petrol are now making their appearance. These will render a wonderful service to motorists after closing hours.

A special adaptation of automatic servicing is the idea now being sponsored in the United States for selling special television programs.

The idea is that better and therefore more highly paid artists might be available to those who wish to pay for that special service, instead of getting television free as at present.

A system has been worked out which provides for television transmitter transmitting in the usual manner with one exception. The picture and speech is deliberately "scrambled" or incomplete at the transmitting end, so that it arrives in an unintelligible manner at the receiver.

By means of a specially punched card which is previously bought by the "viewer" for a days or weeks program and which is inserted in an electronic device on the receiver, the picture and speech is unscrambled and is viewed and heard in a normal fashion.

TELEPHONE SIGNAL

Another method of "unscrambling" is by means of a device on the receiver connected by the normal telephone line to the transmitter. You simply dial a specified number, whereupon the operator at the transmitter sends certain impulses through the line to the receiver. These unscramble the "works". A charge is booked up to you at the transmitter.

Other methods have been devised which are too technical to talk about here.

Considered in all its aspects, life is going to be fairly easy in a decade or two for a lot of people but who is going to feed 'em is another matter. That is unless someone can devise a complete push-button farm.

TELEVISION NEEDS GOOD SOUND

A television programme isn't all picture. Here, overlooking sound stage E at the BBC's Lime Grove studios is a sound control room which is a good deal more pretentious than many similar control rooms in a sound-only broadcast station. Through the window at the left is the announcer's booth.

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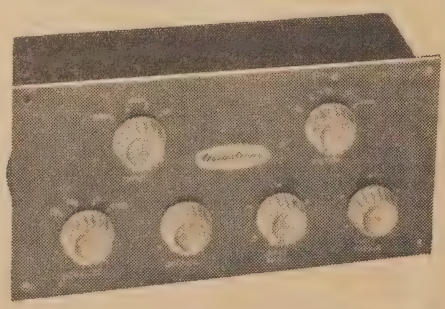
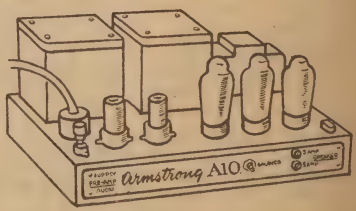




HF CONTROLS POWER STATIONS

ain of ultra high frequency transmitters using 150ft steel towers is being shed by the Electricity ission of NSW for the re- control of major metro- politan sub-stations.

s part of an extensive system unications, remote switching, rvision of power stations and s, which is being set up to e Commission's interconnected

uarters will be a new system entre in Sydney where the out- ll power stations in the State dicated and the most economic of the whole system deter-

e switching of substations and ectors will be decentralised, ried out at the Sydney centre metropolitan area), and at the regional control centres at e (northern region), Goulburn region), and ultimately Orange region).

R & RADIO

ese purposes both radio con- the "carrier" communications uperimposed on the commis- n 132,000 volt power lines will ded.

w system will be both cheaper reliable than the use of under- ontrol cables which are expen- stal over long distances. How- use of such cables will be and extended where distances

ations have already been laid al of the metropolitan radio hich will be erected at Home- rlingford, Blacktown and Port substations, and subsequently areas.

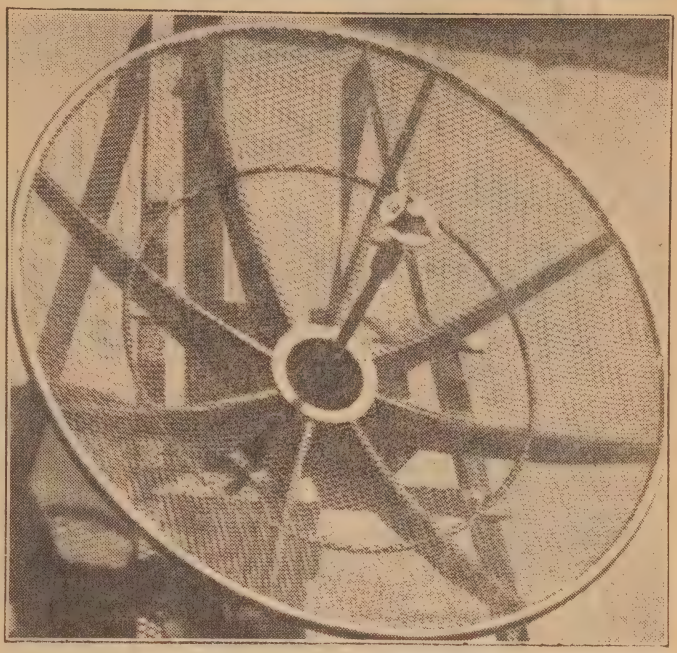
FREQUENCIES

dio system will utilise four dis- uencies at just under 2000Mc 1835, 1875, 1935 and 1975. lighthouse valves are being FM techniques using reactance n.

ailability of four channels will possible to operate both ways ously and to duplicate circuits breakdown might have serious ons. Automatic transfer and cuits are being incorporated.

annels will be set up to operate lowing fashion:

k on say 1975Mc may be set smit from one end of a circuit t 1935Mc from the other end.



Parabolic mesh reflector. These will be mounted in pairs at the top of 150ft high communication towers erected for the N.S.W. Electricity Commission.

On to each of these UHF radio channels, in each direction, it will be possible to superimpose ordinary cable type carrier channels, each 4000 cps wide, up to 24 in number.

Each of these 24 channels will be capable of carrying speech but, in practice, only one may be set apart for this purpose.

The remaining channels will be modulated by simple tones 120 cps apart and lying in the range 660 to 3180 cps, viz.: 660, 780, 900, etc. The tones will control various equipments or convey information relative thereto.

For this latter purpose, quantities such as megawatts, megavars, volts, amps, etc., are signalled as impulse rates. Thus zero impulses per second will mean zero volts, and 1200 impulses per second may indicate 132,000 volts.

For the control of switchgear, etc., coded impulse trains are sent over these pilot channels to effect the required operation.

TRANSMITTING TOWERS

The electric Power Transmission Co. is under contract for the erection of the first nine towers in the metropolitan area, and American RCA radio equipment has been supplied through AWA for installation on each tower as it is completed. The carrier channel apparatus has been contracted for by STC who are making it locally.

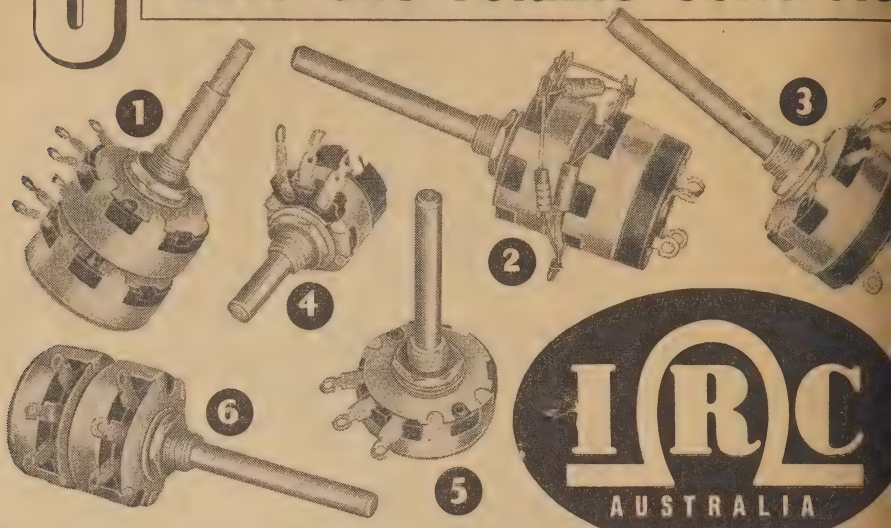
When the new system is fully established:—

- **The central control room** will have an immediate picture of the demand at the regional control centres and direct communications with them.
- **Individual indications** from all power stations in the State and major metropolitan substations will appear on 7ft high control panels covering 100ft of wall space.
- **The regional control centres** at Newcastle and Goulburn and eventually Orange will maintain similar supervision in the northern, southern and western regions respectively.

REMOTE CONTROL

- **Diagrams** built up on a mosaic pattern will reproduce circuit conditions at the substations and indicate switching operations.
- **Remote control** of these substations will be possible from the control centre.
- **Discrepancies,** overloads, and the operation of protective devices will be indicated by alarms and illuminated panels.
- **Switching** will be carried out by radio impulses and the result automatically reported back to the control centre.

6 different volume controls



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RESISTANCE VALUES—Carbon Types: 500 to 10.0 Meg.; Wire-Wound Types: 5 to 10,000.

TAPERS—Carbon Types: Linear A or log. C. Wire Wound: Curve A (linear).

2 Type LBI Loudness Control Fit NEW IRC Type LBI Continuously Compensated Variable LOUDNESS CONTROL to your radio or amplifier and automatically keep the proper balance of all frequencies within the audio range at ANY listening level. Boosts highs and lows as volume is decreased, maintains depth and brilliance even at whisper level in any radio receiver. The Loudness Control will replace any volume control by transposing three simple connections. Can be fitted without experience. Available in 1 meg. 500,000 ohms, with or without switch

3 Type CS Metallised Control

RESISTANCE VALUES—500 ohms t 10 megohms in log. or linear taper.

SHAFT—¼in. diameter, machined not di cast, standard stock lengths 2¼ins. and 3½in **Shaft insulated.**

COVER—Cover grounded to bushing.

SWITCH—S.P.S.T. or D.P.S.T. and D. special for reactivation.

TAPS—One standard, also centre tap co trols available in linear taper in 500,000 an 1 megohm.

TAPERS—Logarithmic and linear standard

4 IRC Miniature Type Q Volume Control features small size, 15/16in. dia., terminals riveted to element, superior performance, moulded bakelite base.

CONTROL BASE IS MOULDED of high-strength, first-grade bakelite which eliminates mechanical distortion and moisture absorption associated with the use of punching bakelite.

WIDE RANGE of resistance values and tapers, with or without taps.

ELECTRICAL ROTATION—300°.

SHAFT—2¼in. and 3½in. dimension "A" standard, insulated ¼in. dia.

COVER—Earthed.

5 Type W Wire-Wound Controls

RESISTANCE VALUES—Available in all standard values between 5 ohms and 10,000 ohms, 2 watt rating.

WATTAGE IN ROTATION — Mechanical rotation 295°. Electrical rotation 266°.

ALL SHAFTS ARE INSULATED—Maximum operating voltage from any terminal to ground is 900 volts RMS at standard atmospheric conditions.

DIMENSIONS—Diameter, 1¼ins. Depth from mounting face, 9/16in. Shafts ¼in. dia., ⅜in. bushing. Standard shaft length, 2¼ins., from front plate to end of spindle.

6 Ganged Type Controls

Available for a multiplicity of applica tions in amplifying and electronic equip ment . . . in 2, 3 and 4 gang . . . in eithe metallised type CS or wire-wound type W Operation from common 2¼in. shaft.

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Wire-Wound Type W—5 ohms to 10,0 ohms in linear taper only.

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Technical Review

IONOGROOVE" — A NEW STEREOPHONIC RECORDING

e it has long been recognised that twin or multi-channel sound ms, having varying degrees of stereophonic quality, have many ntages over a mon-aural system, there are many problems of reli- y and economy yet to be solved. The following scheme, described hn T. Mullin, of Bing Crosby Enterprises, might well offer a solution to the problems.

IOUS experiments have made it ar that a three-channel stereo- system is almost completely lowever, the greatest step for- n tsereophonic quality arises two-channel system takes over e monaural.

from two to three shows a improvement, of course, but so joyment can be had by the ad- f a second channel to an ex- ngle channel that this becomes l, economical step for the home st

es of the two-channel program are limited at the present time sional two-channel broadcasts adcast stations, and to special cords containing two separate These have been a stimulus listener to set up two-channel onic equipment and much cre- ie to the people who have made roadcasts and records available.

E GROOVE SYSTEM

n's paper describes a two-chan- recording system which is un- elopment by Bing Crosby En- Inc. at the present time. It is of providing two distinct chan- stereophonic sound in a single ord groove. This it does by f two-way stylus motion.

ugh virtually obsolete again to- second time round), vertical or l-dale" recording has long since itself to be a high-quality of disc recording. Lateral re- is the accepted standard today, 78-rpm standard grooves or on

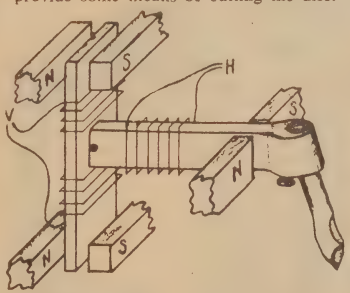
is no fundamental reason why al record and a lateral record be simultaneously cut by one One great advantage of such a is found in the positive reten- c phase relations between the als.

exist, in the professional field, kups of well-known design e capable of reproducing either al or a lateral record. These RCA 4875 and the Western 9-A.

itch is normally provided to change operation to vertical or lateral, but the coils of the vertical and lateral units are capable of being wired in bridge circuitry in such a manner that the vertical motion of the stylus may always generate a signal at the input of one amplifier while lateral motion may generate a voltage which appears only at the input of a second channel amplifier.

Thus, without special design, pickups exist which can be adapted for present-day demonstration purposes. Obviously, many of the existing commercial pick-ups for home use could be replaced by inexpensive modified versions which could generate signals in this manner.

The problem of playing a "VL" (vertical-lateral) record is therefore almost non-existent. The main problem is to provide some means of cutting the disc.



Simplified diagram of the experimental cutter designed to record both laterally and vertically at the same time. Although not perfect, results are very promising and justify further research.

This has been overcome in an experimental recorder of somewhat limited frequency response in the manner shown in the diagram.

Three coils are wound about the legs of a T-shaped armature structure which is supported in magnetic fields at the point indicated by the black dot at the centre of the T. This support provides two-way compliance as a pivot, so that the cutting stylus can move laterally or vertically.

If an alternating current is applied to the two series coils marked V, it will be observed that a vertical motion is imparted to the stylus point. Similarly, an alternating current applied to coil H will drive the stylus laterally, all motions being in the nature of rotation about the pivot centrally located in the T armature.

Crosstalk might seem to be an objectional feature of the system. Actually, undistorted crosstalk turns out to be no problem at all, since in effect it only reduces the apparent separation of the loudspeakers in the reproducing system.

NO GREAT WORRY

Any such crosstalk can be reduced in effect, if it ever should become loud enough to become objectionable, by separating the speakers very slightly. Actually, it has never been so loud in tests made so far as to warrant this.

Generally, a vertical record will not crosstalk with high distortion into the lateral amplifier.

On the other hand, the highest distortion produced in the system occurs because of pinch effect of high-amplitude lateral recordings causing vertical motion of the stylus. This is strongly second harmonic and under certain conditions can be slightly noticeable.

Since it is reproduced from the vertical loudspeaker while a loud sound is emanating from the lateral speaker, there is fortunately a great deal of masking of the audible distortion.

No percentages of crosstalk or distortion are given herewith, since they would be quite difficult to interpret in the face of the rather limited response and inherent distortion of this experimental cutter.

PLAYING TIME

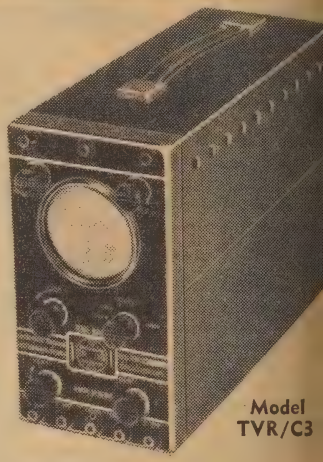
Commercially, this system enables a disc to run the normal playing time, since the included vertical tract requires no additional groove spread. Before he installs his VL pickup and second amplifier and speaker, the high-fidelity enthusiast can play VL records on his present lateral pickup provided that it has reasonable vertical compliance. The Weathers and GE pickups work nicely in this manner.

Thus, the VL system of stereophonic sound is automatically (to borrow a term from the color television people) a compatible one. From what work has been done to date, it promises, as an alternative to two- or three-track tape systems, to point the way to the future large-scale introduction of a "stereo" sound in the home.

UNIVERSITY TELEVISION TEST INSTRUMENTS

OSCILLOSCOPE 3in

This portable Cathode Ray Oscilloscope is invaluable for TV and radio service work as well as industrial use. It is equipped with individual high gain amplifiers having a wide frequency response and low phase shifts for both horizontal and vertical deflection. It is designed fundamentally for the servicing and adjustment of TV receivers and radio receivers and has a number of new features. Vertical amplifier frequency response 15 cycles to 150 kilocycles, plus or minus 1 db and 6 db at 1 megacycle. Size is only 4½in x 8½in x 11½in.

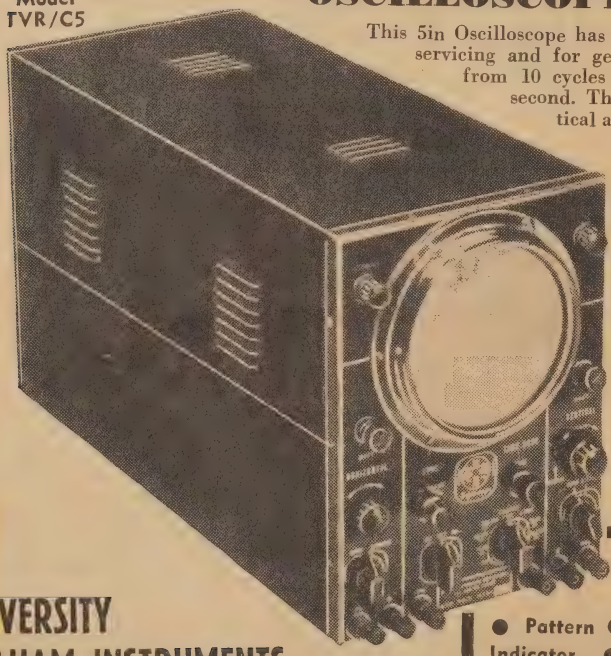


Model TVR/C3

Model TVR/C5

OSCILLOSCOPE 5in

This 5in Oscilloscope has been developed for TV and ra servicing and for general purpose use at frequen from 10 cycles per second to 5 megacycles second. The frequency response of the tical amplifiers in the normal positio 10 cycles to 1 megacycle, plus minus 1 db. In the wide b position the frequency sponse is from 5 cycles second to 3 megacycles second, plus or minus 1 The sensitivity in this p tion at 6 megacycles is mi 3 db. Horizontal amplif have a frequency respons full gain from 20 cycles 1 megacycle, plus or mi 2½ db. The time base ge ator has a frequency ra from 15 cycles per secon 250 kilocycles in seven co steps with a fine control



Other TV instruments include:

● Pattern Generator ● Field Strengt Indicator ● Vacuum Tube Voltmet ● Sweep Oscillator ● R/C Bridg ● Multimeter 20,000 opv. ● Valv testers, Multimeters, etc.

UNIVERSITY GRAHAM INSTRUMENTS PTY. LTD.

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"BELT-AND-BRACES" TV TRANSMITTER FOR BBC

bility of transmission has been a major require- in any radio system and present day equipment ves this to a very high degree. Some idea of this is achieved can be gained from a descrip- of a typical installation—that of the new BBC television transmitter at Crystal Palace.

NEERS adopted such a imistic outlook in designing this on that it has been christened t-and-braces" station; doubtless character who used both these to secure his nether garments played tennis!

ore serious vein, it is a fact y elaborate precautions have en to ensure continuity of ser- he event of faults occurring in pment. Practically everything cated. As can be seen from ram, there are two vision trans- nd two sound transmitters and of crystal drive equipment and d sound input circuits.

the aerial is arranged as two lently fed sections. (It is actu- mporary aerial, but the perma- e will be constructed on the nciple.)

UR IN USE

normal conditions all four ers are working simultaneously. uts of vision transmitter A and ansmitter A are combined and ne section of the aerial, while uts of vision transmitter B and ansmitter B are combined and ne other section.

re is a breakdown in one half ystem the other half continues g—but giving, of course, a re- in output power from the sta- 6 db. In addition, however, a most elaborate switching sys- ch enables various combinations airs of transmitters and aerial to be made.

is brought into action if the not be cured quickly, the idea permit a combination of trans- nd aerial sections that will give it power reduced by only 3 db

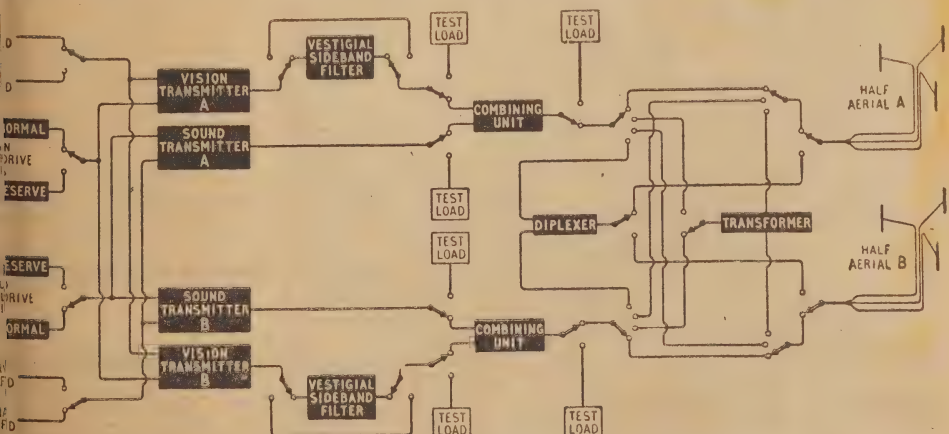
Going up! Here, under construction, is the tower for the new London BBC television transmitter at Crystal Palace. Total height is 640 feet—over 200 feet above the level shown in this picture. A duplex aerial system allows the station to carry on at reduced power in the event of a partial aerial failure.

instead of 6 db. For example, both pairs of transmitters can be switched to either half of the aerial via the diplexer, or one pair of transmitters can be fed to both halves of the aerial via the transformer.

It can be seen that each transmitter has a test load, and this is used to enable any fault to be located and put right under running conditions, while the rest of the station continues in operation. Also the vestigial sideband filters can be short-circuited out if any trouble develops in them.

Incidentally, although both vision transmitters are fed from the same crystal drive unit (and likewise the sound transmitters), this in itself does not ensure that both RF outputs will arrive at their respective half aerials in phase. So to prevent the embarrassing situation of one transmitter "pushing" while the other is "pulling", a phasing system has to be included in the equipment.

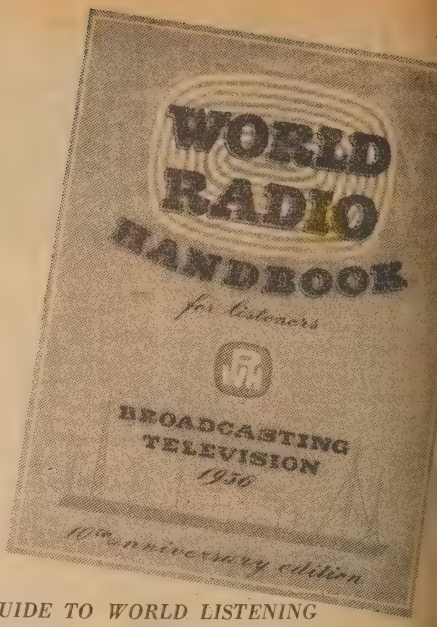
This consists of a phase comparitor working from pickup points on the output feeders of both vision transmitters, A and B, and manual phase shift controls in the drive units of the transmitters (with a similar arrangement in the sound transmitters). Any phase discrepancy between the two is indicated by a centre zero meter in the phase comparator, and appropriate adjustments are made to the phase shift controls to correct it.



schematic diagram of the duplicate chains of transmitting equipment, with relevant switching arrangements, in the new BBC Crystal Palace Transmitter. It has gained the nickname "Belt-and-Braces".

Here is what this up-to-date directory will do for you:

Complete ● Correct ● Compact



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W FRENCH RAIL CARS TO RUN ON RUBBER TYRES

current experiments are successful, rail cars on the Paris Metropolitan Railway may soon running smoothly and quietly on heavy-duty tyres originally designed for punishing road vice. Problems of loaded weight and of guiding the cars appear to have been solved in a prototype which has been in service for several years.

idea of using rubber tyres on the ris Metropolitan Railway is not s early as 1932, the Michelin rub- ory made tests with a car mount- road tyres, and guided by a cen- il.

y-duty tyres did not then exist. uently, twin wheels had to be which increased friction in the

Also, the complexity of the witch gear made the practical ion of this device difficult and was temporarily abandoned.

-TYRES"

Michelin plant then confined it- tests with tyres running on the of rail (rail-tyres), the vehicle uided by a steel plate which func- like the flange on traditional roll- ck.

hole series of "Michelines" (rail ppeared on the French Railways nore recently, the trains with tic tyres on the Paris-Strasbourg ris-Basel lines.

system could not be applied to is Subway because of the limit- ght which can be carried by the es, about 2640lb.

aris Subway carriage, 49ft long, able to transport 200 passengers load, or a load of 14 tons. The ed carriage, when empty, and ith a very light body, weighs at tons. Therefore the tyres must to carry a total weight of 34

950, two new factors emerged: The development of metal rein- road tyres, capable of carrying load with a wheel diameter of n 1 metre.

new guiding system, combining of horizontal wheels supported al guide-bars on a running line, metal flanges for passing over witch gear of the standard rail- pe.

roup of French constructors to build a prototype automotive ccording to this principle.

OTYPE COACH

coach consists of a body 49ft d 7.8 feet wide, resting on two e bogies.

axle comprises two wheels fit- h "metallic F 20" road tyres, on tracks 30 centimetres wide. by side with each carrier wheel, fety rail running alongside. wheel is used only in case of a e, thus ensuring continued opera- d safety.

a running line, the horizontal fitted with pneumatic tyres bear ral bars and ensure frictionless seless guiding without wear. The f the safety wheel is then 13 mm e flank of the rail.

passing over track switch gear, ies can no longer be guided by izontal wheels. Therefore, from ment the coach enters the track gear section until it leaves it, the guide-bars go out of action. Guiding is then ensured by the safety wheel flange, the lowest point of which is constantly 35 mm below the running plane.

The switch gear is of the conventional type. The running surfaces are extended when crossing tracks, except for narrow grooves which correspond to the passage of the wheel flanges. Throughout the crossing, the coaches are always resting on the carrier tyres.

The guide-bars also serve as conductors to feed the necessary current to the automotive coach.

Current reverse is ensured by the safety rails. Positive and negative collecting shoes are mounted on the bogies. The prototype automotive coach has two 130 HP motors placed beneath the body, each driving the axles through a cardan shaft.

The two motors coupled in series, then in parallel, are controlled both in traction and in braking by an electric camshaft. At the beginning and end of braking, rheostatic braking is automatically combined with pneumatic braking, controlled by an electrovalve.

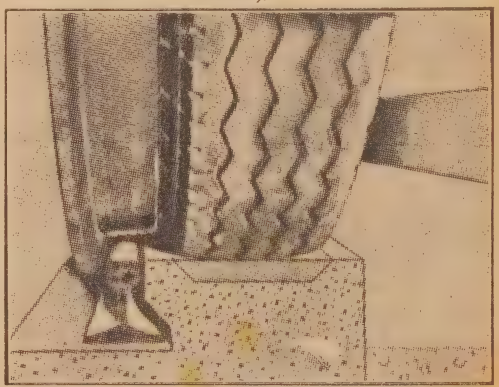
The prototype automotive coach weighs 20 tons, and holds 154 passengers (24 seated) when normally loaded, and 200 passengers at peak loads.

It was tested on the 800-metre underground line between the stations "Porte des Lilas" and "Pre Saint-Gervais".

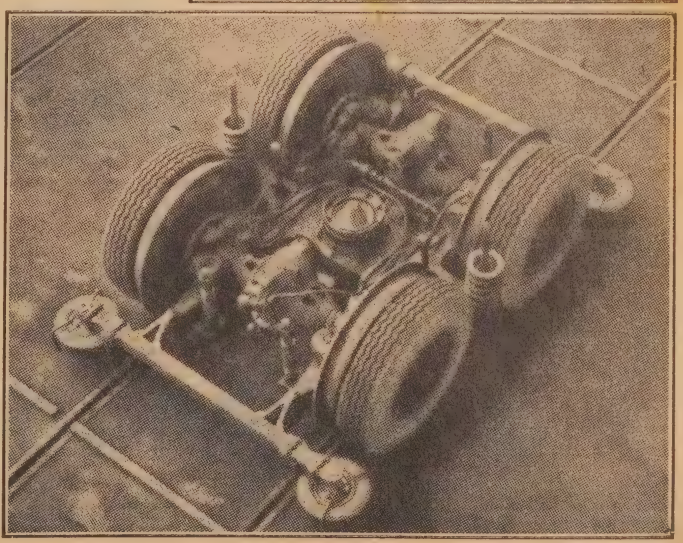
After a few months' tests and necessary adjustments, the automotive coach was put into passenger service on April 3, 1952.

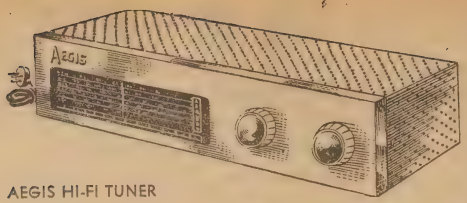
Additional ballast of 6.5 tons was placed beneath the seats and on the end platform so as to furnish an average permanent load. On March 1, 1954, the coach had covered 37,500 miles, the tyres showing only very slight wear.

("French Economic and Technical Bullentin").

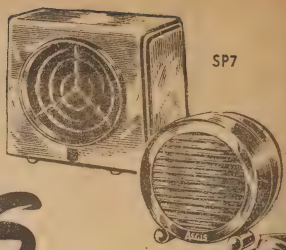


This sketch shows the flanged steel wheel (left), the rubber-tyre which carries the load and (right) the side rail on which the horizontal guide wheel bears. Below is shown one of the bogies of the prototype car. Note the four horizontal guide wheels, also the motor and transmission system.





AEGIS HI-FI TUNER



Your best buy! AEGIS

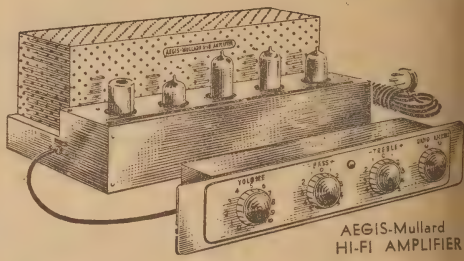
RADIO PARTS AND COMPONENTS

Aegis parts are made in Australia to suit our conditions. Your guarantee of reliability is in the trade-mark, AEGIS!

AEGIS HI-FI TUNER: Latest Aegis development. Features newest circuit techniques and miniaturisation of components. I.F. Stage has band width nearly double that of ordinary receivers. Combined with any good treble boost circuit of an amplifier (preferably the Aegis-Mullard 5-10) will give the desired response from broadcasting stations. PRICE: £31.

AEGIS EXTENSION SPEAKERS: Modern plastic cabinets. SP7, 11¾in x 4¾in x 10¾in high (tapered). 7in speaker. Walnut or natural. PRICE: 139/-.
SP6, 4in x 7in (circular). 6in speaker. Black, Walnut, Natural, Pink, Blue or Green. PRICE: 109/3.
SP5, 2in x 7in (circular). 5in speaker. Walnut or Natural. PRICE: 73/6.

AEGIS-Mullard 5-10 HI-FI AMPLIFIER: Rated power output 10 W. Max 12-13 W. Frequency response + or — 0.5db, 10c/s to 20,000c/s. Output impedance standard 3.75 ohms and 15 ohms. Alternative impedances avail. Amp.: 11¾in x 6¾in x 6in. Tone Control Panel: 12in x 3in x 1¾in. PRICE: £54/5/-. Also in Kit form, PRICE: £36/15/-.



AEGIS-Mullard HI-FI AMPLIFIER

M18 AEGIS SIGNAL MAGNET (Loop Aerial). Insulated flexible mount. Ferroxcube Rod—possesses extremely high degree of permeability. Improved selectivity and sensitivity. PRICE: 24/6.

M18

MF1 AEGIS MAINS FILTER. Eliminates interference coming through electrical mains. PRICE: 56/-.

MF2 LINE FILTER. Extra inductances for greater efficiency. PRICE: 69/3.

AF1 AEGIS AERIAL FILTER SYSTEM. Completely dispels noise interference in both broadcast and short-wave. Aerial wholly assembled. Complete instructions. Boxed. PRICE: 192/9.

AF1

CO

COILS AND I.F.s. M9 Coils B/C aerial; M11 Coils B/C osc. 6AN7, 6J8G; M10 Coils B/C RF, 6BE6, 6AE8; All priced at 17/9 ea. I.F. Transformers—J9 intermediate 455KC No. 1; J10 intermediate 455KC No. 2; priced at 19/3 ea.

AEGIS TUNING KNOBS. MV12 Concentric 2-piece, PRICE: 2/6. MV11, 1in diam. PRICE: 1/4. MV10, 1¼in diam. PRICE: 1/4. MV9, 2 1/8in diam. PRICE: 2/1. All available in walnut or cream.

AEGIS TUNING POINTER. Black bakelite, metal insert. PRICE: 1/4. Heavy duty Pointers, brass insert. PRICE: 2/-.

PACKAGED HARDWARE including assorted nuts, bolts, cored solder, etc. PRICE: 3/- pkt.

KNOBS

POINTER

● ADVANCE AEGIS T.V. COMPONENTS

We are Australian Agents for Sydney S. Bird Ltd., Whitely Electrical Ltd., and Enthoven & Sons Ltd., all of England, renowned for TV Components. **Write NOW for details of the TV Components soon to be released through AEGIS-MAGRATH.**

J.H.MAGRATH

AND CO. PTY. LTD.

1st. Floor, 208 LIT. LONSDALE ST. (between Swanston & Eliz. Sts.) MELB., VIC. FB3731

ROM THE EDITOR—OVERSEAS

ve always believed that the hot, humid summer of New York is something to avoid at osts. I arrived there in the full bloom of a record heat wave, and can therefore confirm from practical experience that all I have heard about its unpleasantness is true!

or the fact that most big ings are air-conditioned, life ve been unbearable in this city, built on solid rock, rned with great man-made equally efficient as collectors ers of heat.

el was almost on the corner way and 42nd St., heart of re land, the fun parlors, the drug stores and gift shops, ck, and, apparently, sell, the collection of junk man's in- could ever assemble in one

spot and in nearby Times where 7th Av. meets Broad- ll cross-section of New York d jostles all night and all ple of all sizes, shapes and e busy, the leisured, the lazy eadbeats.

SIGNS

and around, in a blaze of l colored lights, great adver- ns are never extinguished. one nearly half a block long m of a green waterfall, mount- ch side by an outsized bottle us soft drink.

a half life-sized model of a nstellation is in a state of sus- ake-off, high over the heads izens who dive in and out of s Square underground station, st, dirtiest, and busiest in the

ctions to the mighty buildings r-ending procession of glamor- were much the same as those people who hit the world's y for the first time.

ple of days I sweltered and out in the heat in a perpetual il I discovered that the streets ues are so numbered that nearly ce is easy to find, unless it is r the tip of Manhattan Island. e numbers begin.

even hardened New Yorkers get lost in the maze of build- k shops and eating houses. records, and TV figure more tly than any other single form andise, except perhaps clothing . New York is the world's centre of entertainment, both sound.

ny people live in the tightly- ocks of flat buildings, that the of the city are their only ground. Their eternal home are the radio and more par- the TV screen.

ning TV, the US has it in a ted form unequalled by any ntry, and New York has ex- on an unparalleled scale. Every hotel worthy of the name has a set installed in each room.

Every bar and eating-house has at least one parked somewhere on the premises and, judging from the ungainly fungus of aerials which are jampacked on every flat building, no domicile in the city, be it ever so squalid or humble, is without a set.

And, believe me, some of the areas such as Harlem and the Bronx, centres of the colored population, are really squalid.

Advertising on TV, the only source of program income, is carried on at an unbelievable pressure. From the word go, one gains the impression that one half of the USA makes something, and the other half sells it. But everybody seems to buy, with cigarettes and beer possibly the most favored items.

Advertising matter is mixed with entertainment in such abandon, that it is hard to establish in many cases, just where one ends and the other begins.

During the morning hours, strange characters, apparently with a huge home following, perform their own patter-acts, aided by all kinds of gimmicks, fall-guys, song-and-dances, &c., all of which, sooner or later, lead us to the inevitable plug for a sponsor's goods.

Some of these sessions are quite amusing—others are, on the surface at least, so puerile as to puzzle the newcomer beyond belief. But American audiences love them.

THOSE BALL GAMES

Then of course there are the ball games which, in New York at least, seem to go on almost without a break from about midday until 9 or 10 p.m., Sundays included. The Brooklyn Dodgers, for instance, have apparently sold their TV services to two main products. After each game, smoking one and drinking the other, characters analyse the play, and interview the players.

After a while these ball games get you in. The merciless quick fire of advertising plugs, wears down your resistance sooner or later. Both advertised items were OK.

In New York, where most of my viewing has so far been carried out, films play a great part in the programs. Some of these are quite old and quite poor.

Hopalong Cassidy, Roy Rogers, The Lone Ranger, and others, are highly popular stars, and frankly, I thought the Westerns showed up extremely well as entertainment.

In the evenings I saw some excellent films, many of the best coming from British studios of yesteryear. Odd variety shows and turns are of mixed quality, and usually I found myself settling for the best of the films or a ball game, if there was one.

The "Late Late Show" I found a particular menace — generally a film which went on about midnight and finished in the early hours. I can see many red-eyed Australians catching the 8.25 am to town after a few nights of these, that is, if we get them back home!

Of necessity my experience of American program material so far has been limited to a few weeks. I would stress presentation rather than content.

PUT IT ACROSS

There is a slickness and a finish to American TV which far exceeds anything I have seen so far. In this one sees the years of Hollywood technique and show business, which has been a stock in trade of the US for decades.

Irrespective of the program matter, the Americans are second to none in the art of getting it across.

Even the advertisements, which shoot forth with bullet like regularity and precision, have characteristic finish. A couple of TV spruikers, who specialised in selling goods for the home trial with fabulous quality and low prices, always amused me with their technique.

If they had been a pair of hot gospellers, they could not have projected their stories with greater speed, force and sincerity. Their flashing eyes and pointed fingers had me cowering in a corner, groping for a telephone to place my order while there was yet time!

There seems to be some TV available almost any hour of the day or night in the big cities. Plenty of channels, too — New York must have about 10, and Chicago five. There isn't any doubt, the magic screen over here has become so much part of everyday life, that most of the people would be lost without it.

VARIOUS FAULTS

Technically, I was rather disappointed in the pictures as I saw them. Undoubtedly the 525 lines do give a picture appreciably better than the British 405-line system, when everything is operated as it should. But, in many cases, I concluded that the engineering standard in both receivers and transmitters were not as good as that in England.

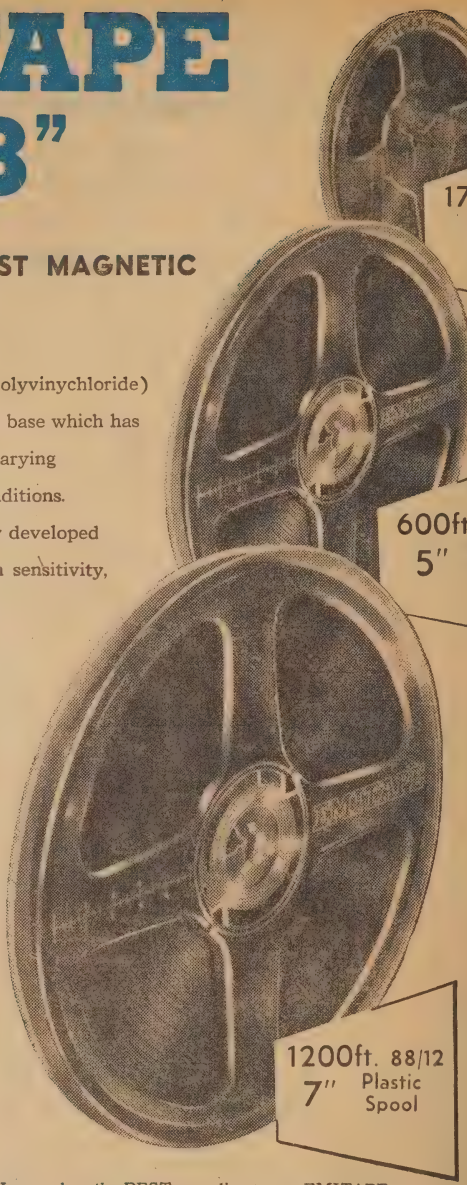
Some of this is due to films, so old or so bad, as to give really sub-standard pictures. Some of it is due to sets which do not offer a wide enough bandwidth—the tendency here is not to bother if some band attenuation takes place. But I also suspect that some of the trouble often lies in transmitter adjustment.

One New York station issued a picture which showed a background of modulation in step with the sound-carrier, while others, from time to time.

EMITAPE "88"

THE WORLD'S FINEST MAGNETIC RECORDING TAPE

EMITAPE "88" uses P.V.C. (polyvinychloride) high tensile film base—the film base which has strength *plus* stability under varying temperature and humidity conditions. EMITAPE "88" has a specially developed magnetic oxide coating of high sensitivity, with an electrical specification designed to achieve the maximum performance from all tape recorders, all speeds, single or twin track.



EMITAPE is used by the leading Broadcasting organisations and for the recordings issued under these world-famous trade-marks —

"HIS MASTER'S VOICE"

COLUMBIA

PARLOPHONE

You can buy the BEST recording tape—EMITAPE—at these *new reduced prices!*

88/3—price, 12/-. The finest value for short duration recordings, giving over 8¼ minutes' single or over 17 minutes' twin track at the speed of 3¾" per second. The ideal "Personal Message" medium for the mail.

88/6—price, 34/6. Now provided with metallic contact strips for tape recorders fitted with auto-stops. The spool size for all tape recorders, single or twin track.

88/12—price, £2/18/-. The popular standard size spool for the larger, high-quality recorder.

E.M.I. (AUSTRALIA) PTY. LIMITED, ENGINEERING SALES DIVISION, 301 CASTLEREAGH STREET, SYDNEY, N.S.W.

TR.

transient faults to appear, which ook too good to me.

engineers to whom I spoke admitted that technical stanwere largely a compromise becost and optimum acceptable A station which had to balbudget often had to accept a of maintenance lower than was e. Apparently, too, the Ameridiences are much less critical ire quality than one would ex-

all, a home run is a home en if the player is not in good or has a halo along one side of y!

most popular screen size here whelmingly the 21-inch. Screens o 27in are available, but I am at the public generally doesn't hey offer enough for the extra Small screens are almost exy for "second" or "personal" hich are now appearing on the

SALES

has just released a most atlittle job for 125 dollars, and are on the way. The appearf these smaller sets seem to that America has largely saturpublic with initial standard TV, moving into the second stage of ng secondary fields to keep total oving.

just incredible to see how much s spread over the length and of the land.

of records, too, are so large soon forgot them in trying to er whether the figures given n thousands or millions. The plant, at Indianapolis, which I st visited, turns out about 1½discs every week, both for ves and for other record com-

takes nearly 200 presses arin pairs, some of them fully tic. This may be the biggest fact it is only one of many. In ork there are streets in which big record shops and hi-fi parlors in every block. Some of these tual emporiums where you can most every label in the world.

there is no let-up. Tape seems or a big drive in the near future, h the microgroove disc seems in its universal acceptance for years to come.

RESEARCH

ood deal of my time has been t various establishments of RCA, International Division, under the e of Mr. George de Arellano, o enormous trouble to fit things my often rapdily-changing le.

particularly interesting visit was David Sarnoff Research Centre ceton, where most of the RCA's developments are carried out.

I saw old and new devices s the "magnetic memory" grid, test all-transistor receivers, the ght amplifier in the world, an nic music machine which can luplicate the human voice with sable intelligibility and the ultra-

(Continued on Page 103)

Here's the exclusive
METALLISED PAPER PRINCIPLE
that puts Microcap so far ahead for performance

ONLY Microcap

is wound with the special patterned metallised paper. The metallised paper technique consists of lacquered paper tissue on which aluminium has been deposited by evaporation and condensation in vacuo. This results in the deposition of a very pure metal with a thickness controlled at approximately four-millionths of an inch.

... only Microcap
Incorporates the modern technique of metallised paper thus producing lightweight ultra-miniature, space saving capacitors.

... only Microcap!
The Self-Healing Feature is a very valuable characteristic enabling the Microcap capacitor to sustain accidental over-voltage and provides an additional safety factor.

... only Microcap!
In the Microcap capacitor the wire pigtail leads are soldered directly to the capacitor unit.

... only Microcap!
They have a power factor better than 1% at 1,000 C/S at 20°C

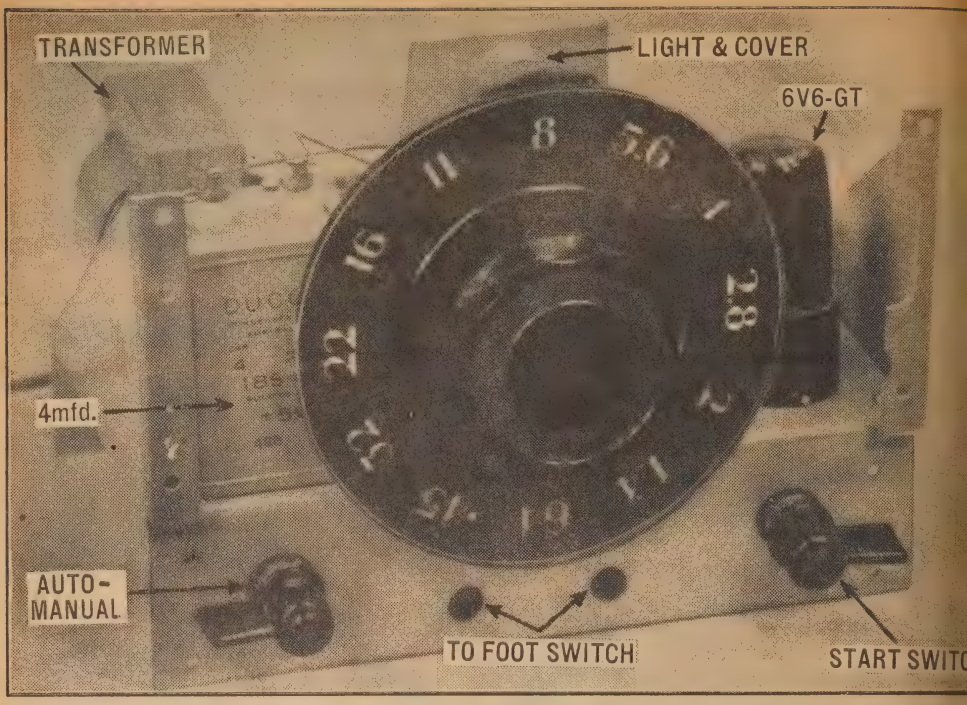
... only Microcap!
An insulation resistance exceeding 20,000 megohms for all values at working voltage of 20°C, is obtained on Microcap Type W99

... only Microcap!
The Microcap W99 with all the BIG features mentioned above offers stable long life in MINIATURE form and is available in a wide range of Capacitance and voltages

Write or call for leaflets giving further technical details of Microcap W99 metallised paper capacitors.

Manufactured in Australia under licence from A. H. Hunt (Capacitors) Ltd., England.

AUSTRALASIAN ENGINEERING EQUIPMENT
CO. PTY. LTD.
476 LATROBE STREET, MELBOURNE. FJ 4161.



Here is the R, T & H Photo Timer, removed from its case. The photograph shows the simple U-shaped chassis and the panel sup brackets. Making the dial should not be a very difficult job for readers whose second hobby is photography.

BUILDING OUR NEW PHOTO TIME

Last month we considered the practicability of an accurate photographic timer operating entirely electronic principles. Having arrived at a suitable circuit, it is our task this mon to describe the actual construction of such a unit. Most of the parts required are standa items available in any radio shop, and the few special components are easily made in t home workshop.

BECAUSE of its ready availability, we decided to build the unit in a standard Radio, Television and Hobbies instrument case. This is a metal box of convenient size, small enough to be easily accommodated in a dark-room, yet large enough to house all the necessary components without crowding and with due allowance for minor physical variations.

It is also large enough to make possible a rather unique dial — something to which we gave a good deal of thought.

It was obvious that we needed an illuminated dial of some kind, since the most convenient location for the timer may not always be the best lighted. In fact, most workers prefer to keep illumination to a minimum near the enlarger, since sensitive material is more liable to fogging in this position than elsewhere.

But, for equally obvious reasons, the dial illumination itself must not create a similar hazard. Thus we must arrange matters so that the dial can be clearly seen, yet not "spill" any appreciable amount of light into the surrounding area. The design we finally chose achieves these requirements particularly well.

The dial is in the form of transparent disc (Perspex or similar material is suitable) and is mounted inside the case The numbers are mounted on this. illu-

by **L. Varady**

minated from behind, and v through a small opening in the fr the case, just large enough to a modate one set of figures.

White (or relatively transparent ures on a black background app give the greatest visibility with the light leakage. We used a sheet of weight printing paper on which t quired scale had been printed, an ened it to the back of the perspe

A small lamp housing enclose dial lamp and prevents stray light ing through the louvres in the s the box. As a result, the only which escapes is that which fin way through the paper of the clea tions of the scale. This is quite though easily visible, but can be even safer by the provision of a filter of some kind across the v aperture.

The result is a dial which is e

ys easy to read, and which pre-
information without any am-

are only two other controls,
" and "MANUAL-AUTOMA-

are best fitted with lever-type
you can get them or, failing
e longer type of pointer knob.
to occupy a normally hori-
osition and move downward
erated.
start circuit is taken to a foot
even greater convenience will
ved.
dealing with the actual con-
of the unit it may be as well
s some of the components re-
d the tolerances and ratings in-

NETWORK

e mentioned last month, the
the instrument is the timing
made up from four resistors
e capacitors. By simple cross
ns on the switch wafers, these
nstants provide twelve time in-

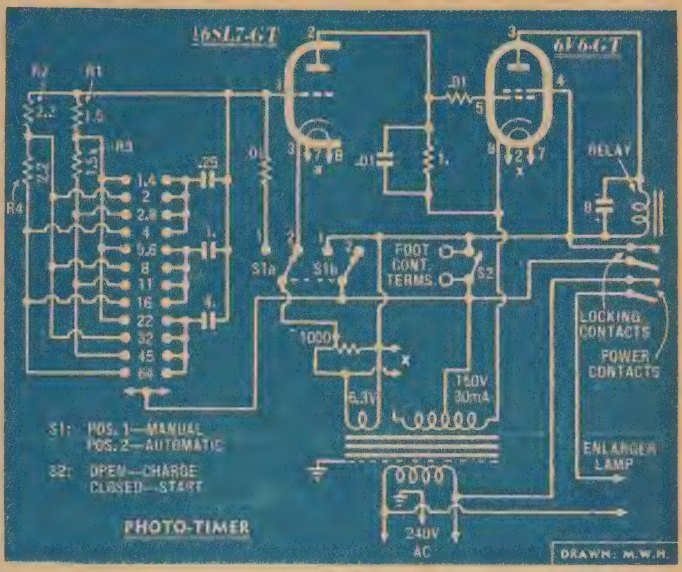
ry carbon resistors have a habit
ing in value over a period of
d their resistance is also sub-
hanges with changing tempera-
his change may amount to as
10 pc during operating periods
ce the temperature inside the
affected by heat from valve
, etc., and the heat dissipated
sistors themselves, it could seri-
pair the accuracy of the cali-

stability resistors, such as have
d in the Audio Signal Genera-
the VTVM, are almost essen-
hese positions if the unit is to
ong-term stability. Ideally, these
have a fairly close tolerance,
or even 1 pc, if these can be
without difficulty.
ver, broader tolerances can be
one is prepared to "pad" them
ies or parallel resistors to cor-
ious errors.
the main resistors be below
ed value to any extent, the dif-
an be made up from low-value
½W resistors wired in series.
e of these will very rarely ex-
re than a few per cent of the
d, even if their value shifts at
date, the error introduced will
gible.

RESISTORS

rly, resistors which are too high
unted with the very high values
the total value a few per cent.
t types are recommended for
stability types, since the energy
l in the resistors will be of this
brief periods.
tors in the timing network must
e arefully selected. A high insula-
tance is essential because leak-
shorten the timing cycle and
e it liable to variation.
for this reason, old disposals
acitors should be regarded with
and should not be used unless
he facilities for checking them.
larger values, new sealed or
capacitors are highly desirable,
new 0.25 mfd. paper tubular
ffice for the shorter intervals.
what we said about resistors,
that close tolerances will also

CIRCUIT IS SIMPLE, EFFICIENT



The circuit is quite simple as circuits go, the only confusing job being the wiring of the resistors and capacitors around the timing switch. Everything round this part of the circuit must be scrupulously clean, to avoid inaccuracy through accidental leakage paths.

be required here. However, 5 pc tolerance is the closest available as a standard line and padding with good quality capacitors may be required.

The main requirement, if the capacitors are not within a close enough tolerance, is that they at least all have the same order of error and in the same direction. We will have more to say on this point later on.

Although for a fraction of the timing interval the voltage across the capacitors may exceed 200 volts, tests have shown that no breakdown is likely to occur if capacitors of 200V rating are used. Besides comparatively low price, capacitors of this rating also have the advantage of small physical size. The values required, 4, 1, and .25 mfd. are standard lines and should be obtainable on order through the normal channels.

As mentioned earlier, capacitors and resistors are combined by means of switching to provide the necessary time constants for the time intervals. Leakage between switch contacts would again

PARTS LIST

1 R-TV-H Standard instrument case 9in x 6½in x 5½in.
1 Chassis 5in x 8in x 1½in.
1 Front panel 9in x 6½in.
1 Power transformer 150V 30mA 6.3V 2A.
1 Relay 1000 ohm (approx. See text) 2 sets "make" contacts, normally open, suitable 240 AC 1 amp.
1 3-bank 1 x 12 switch.
2 2-pole 2 pos. switches (Series 20, type 22) one with spring return.
1 6SL7GT valve.
1 6V6GT valve.
1 Plain octal socket.
1 Ceramic octal socket.

RESISTORS

2 2.2 meg. 1W high stability 1 or 2pc.
2 1.5 meg. 1W high stability 1 or 2pc.
1 1 meg. 1W.
2 .01 meg. 1W.
1 1000 ohm WW potentiometer.

CAPACITORS

1 8 mfd 350 V electrolytic.
1 4 mfd 200V (oil-filled 5 pc preferred).
1 1 mfd 200V (oil-filled 5 pc preferred).
1 .25 mfd 200V paper 5 pc or selected.
1 .01 mfd 400V paper.
1 Large finger grip knob. Type MV1/F or similar.
1 ¼in to ⅜in extension shaft.
Piece of 1/16in Perspex or similar. Sufficient for 5in circle.
1 ⅜in grommet.
1 3-pin flush mounting socket.
Scrap of 1in approx.) coil former for lamp housing.
3 Core flex.
1 3-pin plug.
2 Tip jack sockets with insulating washers.
1 6.3 volt dial lamp.
1 Socket to suit above.
1 6-Terminal tag strip.
1 2-terminal tag strip.

Australia CAN do it!

READ THIS EXTRACT FROM "BROADCAST AND TELEVISION" OF 15th JUNE, 1956

...quipment has been 2UW.
American director of Magnecord, Clayton G. Barker, this week paid a high tribute to Byer Industries Pty Ltd, of Melbourne, who have manufactured under sub contract all Magnecord's broadcast tape recorders up to the present time.
Barker said that American laboratory tests showed the Australian made equipment to be in every way equal to the American and in the case of amplifier construction, the Australian unit was in several ways superior to the American equivalent model.
...on to install this
...get
...com
AFCBS
a free we
for the next
According
tor Burnet
"over all
tion."
The real
that EMI
among br
being fo
coin or
Fe
any r
whic
...ine
...ciate
...time
...to
...ngin-
...now-
...to
...lised
...e civil
...ia and
...olombo
MBS descriptions of
...mbledon te...

REMEMBER

Almost every radio station in the Commonwealth uses tape recorders and turntables - - - - - - BUILT BY BYER

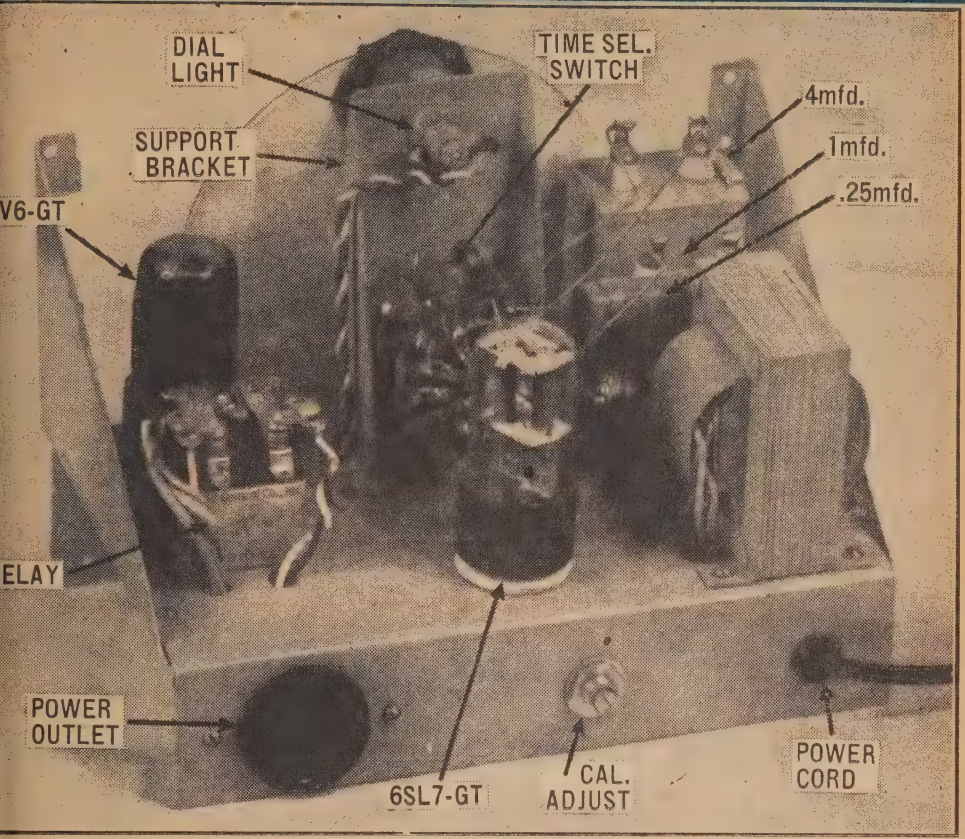
The tape recorder chosen exclusively for Olympic Games coverage by overseas commentators is - BUILT BY BYER

Only the best is good enough, and only the best is - - - - BUILT BY BYER

BYER INDUSTRIES PTY. LTD.
8 DORCAS STREET, SOUTH MELBOURNE
VICTORIA MX5171

byer
SOUND QUALITY

REAR VIEW SHOWING ALL MAJOR COMPONENTS



e major components are visible in this rear view. The only non-standard item is the relay, which actually came from a als dealer. Ex-disposals relays are far cheaper than stock items but you may have to shop to find one suitable.

ne accuracy of the calibration if allowed to develop. Therefore, d quality switch—12-position, ction — will also be essential. e switch looks at all dirty, it be washed in clean methylated nd the wafers should not be more than necessary after this. g on the contacts should be done hot iron as quickly as possible ly resin-cored solder should be The use of soldering paste must ded at all costs, since it contains ls which might adversely affect ilation of the wafers.

properly cleaned ex-disposals with ceramic wafers would be an t proposition for this component. y, a ceramic socket would also for the 6SL7, though neither is t.

IARY COMPONENTS

remaining components need not e high insulation type, since they directly affect the timing circuit. ier important item on the list is y. This should have a prompt ion since any delay in closing ning could introduce a consid- rror into the timing, particularly on the lower end of the scale. Two "make" contacts are required at least, one of which should be capable of handling the full mains voltage and the rated starting current of the enlarger lamp.

The coil resistance is not particularly critical, anything between 600 and 1800 ohms being satisfactory. However, with higher resistance coils, the value of the electrolytic conected across the relay coil may have to be decreased to avoid sluggish action.

Conversely, this value may have to be increased for very low resistances, otherwise the relay may not hold satisfactorily during each cycle, resulting in "chatter".

The supply of relays should not be in doubt, since there are good stocks still available from disposals sources. Operating current, by the way, is about 30 milliamps.

The remaining items are all standard components and require no special comment, except the valves. Both the 6SL7 and the 6V6 can be obtained from disposals dealers at very reasonable prices. These are mostly of the "G" type, with a large glass bulb, but this has been allowed for in the layout of the timer. Should you desire to use miniature valves, the 6BD7 and the 6BW6 respectively are close equivalents with the exception of base connections.

The amplification factor of the first valve and the power sensitivity of the second are both fairly critical and the substitution of valves having radically different characteristics will upset the timing intervals.

And now for the actual construction. As already mentioned, the unit is housed in one of our standard instrument cases, mounted on a simple chassis which most fellows can probably make for themselves.

PANEL CLEARANCE

It is bent up from 16 gauge aluminium sheet and is U-shaped. No end pieces are required, because the heavy gauge material is quite rigid and two panel mounting brackets — of the same material — provide additional support. The chassis measures 8in wide by 5in deep by 1 5-8in high.

The two brackets attaching to the front panel should protrude over the front edge of the chassis by about a 4in. This provides a clearance between the panel and the chassis to accommodate the dial. In addition, the bottom of the

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is fastened to the chassis by means
ts and spacers, thus further stiffen-
assembly.
ther bracket is used to support
ain selector switch and occupies
ntre of the chassis. It also supports
np used to illuminate the dial.
will prepare blueprints for the
and associated metal work and
ite them to the various manu-
rs as usual. Thus you should be
buy your chassis ready made or,
prefer, you may purchase a blue-
nd make your own.
dial mechanism also calls for
detailed comment. Although it
have been possible to obtain a
r switch having an extended shaft,
were two very good reasons for
ing so. One was our desire to use
e finger grip knob, which would
or easy working in the darkroom.
knobs are normally only available
3-8in bush, calling for a similar
aft.

NSION SPINDLE

e was also the problem of fasten-
dial to the shaft. Both problems
implified considerably by using a
witch shaft and extending it with
o 3-8in extension shaft. This auto-
lly allowed the use of the chosen
and also provided a collar on
to fasten a metal flange for the

cut this flange from a scrap of
, though brass would be equally
e. It is approximately 1½in in
er and of about
ge. The exact
of "round-
is not

UNDERNEATH VIEW OF CHASSIS

There is very little wiring underneath the chassis. Heater and power wiring are in ordinary hook-up but the small components are suspended clear of the chassis. Note the tagstrip which provides an anchor point for the three components in the 6V6 grid circuit.

is an exact copy of the photo timer scale. A printed copy on light card be available through the two-shilling query service but readers can copy the above on to printing paper if they so prefer.

critical and it can be easily cut out using a hack saw and file if you have nothing better.

It should have a 3-8in central hole and is soldered to the front of the collar which forms the rear of the extension shaft. Three 1-8in clearance holes are drilled near the outer edge, approximately equally spaced, for bolts to attach the Perspex disc.

This disc is cut from 1-16in thick Perspex or similar material, is five inches in diameter, and has a 3-8in central hole. It is secured to the flange with 1-8in bolts and nuts.

The scale, as already suggested, should be in the form of thin card or printing paper and is glued to the rear of the Perspex disc so that the printed surface is protected. We are reproducing a full size copy of the scale and most photographers could copy this (using the enlarger as a camera) and produce a same size version on single weight paper. Alternatively we are arranging to have copies printed on light card and made available through our query service.

The dial lamp is mounted near the top of the selector switch bracket and it is necessary to enclose this in a light-tight housing to prevent stray light escaping through the louvres in the side of the box.

Part of the light proofing is achieved by using a standard rubber grommet as a mount for the lamp socket and the remainder by means of a simple housing made from a short length of discarded coil former. The piece we used was a cardboard tube about 1in in diameter and about 1in long. It is fastened to the front of the bracket by means of adhesive tape and reaches almost to the rear of the perspex plate.

The gap between them is closed by means of a felt washer—cut from a scrap of some kind—and glued to the front of the tube. Naturally, the hole must be as large as possible, preferably as large as the inside diameter of the tube.

Looking at the chassis from the front,

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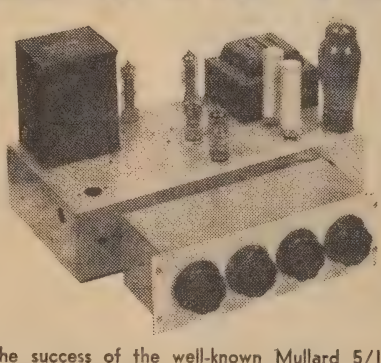

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the layout is as follows: On the hand side near the front are the capacitors, and behind them the transformer. The centre of the c is occupied by the switch and its b with just sufficient room behind the 6SL7 valve. The right-hand accommodates the 6V6, and beh the relay.

After the mechanical work has done on the chassis, and the dial anism assembled, the timing switc be removed from the bracket and as in the wiring diagram on pag

The wafer nearest to the clicker will accommodate the resistor s ing and its terminals are intercon as shown in the wiring diagram. rear wafer has its rotor remove serves as an anchor point for t sistors and any padding resistor may be required. The terminals middle wafer are interconnected as and are used for the capacitor swit

It will be easier to wire the sw it is dismantled for this operation.

ONE UNIT

After the interconnecting wires been soldered into place—a littl with this operation will pay div later—the switch is assembled aga the resistors soldered into position. here on the switch will be hand one unit.

The remaining 2 switches—Aut Manual, and Start—are mounted chassis proper, only their shafts pr ing through the front panel. O rear wall of the chassis, the calib control and the AC outlet are acco dated. These will ultimately pass th the rear wall of the cabinet, as wi the power flex.

The wiring of the unit can be in the conventional manner with hookup wire, with the exception leads within the time constant ne This should be done with bare copper wire, preferably 18g. or he and carefully kept clear, not only chassis, but also of components other wires. This is important, be any leakage developing from these will upset the calibration of the tim

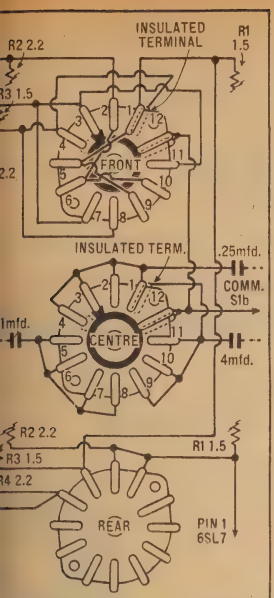
Care should be taken with on minal of the Manual-Automatic s Only a .01 meg. resistor separate terminal from the grid of the time trol valve, and leakage from this ter would upset the calibration. How the normal bakelite switch wafe usually be relied upon to provide quate insulation, provided it is thor ly dry and clean.

FINISHING TOUCHES

Once the wiring is completed, th brackets and the dial mechanism be mounted again and the front added. Finally, the tip jacks for t mote control are mounted on the panel, and connected across the minals of the "start" switch. The i ment is then ready for calibration.

Although a pre-set calibration c is provided at the rear of the uni should be set to approximately position and, once set, should n touched again during the calib procedure. This control affects al ing intervals and is only intende initial setting up and to compensa any possible drift in calibration ageing of components.

The initial calibration must be c out on all 12 settings of the dial accurate stopwatch is handy, if ava



1,4, POS. 2-2, POS. 3-2.8, POS. 4-4
5,6, POS. 6-8, POS. 7-11, POS. 8-16,
22, POS. 10-32, POS. 11-45, POS. 12-64.

diagram shows the connections to ront, middle and rear sections of witch. The last named is used for anchoring purposes and has ntre wiper removed. The connec- shown in the diagram would be e point-to-point in most cases.

unit can be made sufficiently ac- with the aid of an ordinary watch sweep second hand.

eration is best started on the long- ng periods, i.e., when the 4 mfd. capacitor is connected into circuit. For this purpose a small lamp is connected to the outlet, and the instrument switched on. Two things may happen at this stage: The instrument will switch off after the approximate timing period or, it will not switch off at all.

If the latter condition occurs, the timer should be switched off and the HT secondary leads of the power transformer reversed. This will correct the polarity of the triggering voltage and the timer should operate correctly.

The setting-up procedure will vary according to the components which have been used in the timing network and the degree of bother to which you are prepared to go.

CHECKING TIMES

If the components are very close to their marked values, it may only be necessary to check the instrument on the four longest times. Set the calibration control at a position which gives the closest average correspondence between the dial markings and actual times.

Switching the timer to the two lower ranges should then automatically cut the exposure times by 4 and 16, to an accuracy determined by the component values.

It must be realised that the calibration adjustment is an over-riding one that applies to all timing positions. Its prime purpose is to offset the normal spread of valve characteristics and operating potentials. It can also make an overall correction for components which are predominantly high or low in value, but it cannot be used to correct the deficiencies of a single component group.

Any such correction which may be necessary has to be made by "padding" the relevant ranges in the appropriate direction and this calls for careful thought.

Since close tolerance resistors are normally available, they need present no problem. Capacitors will be your main worry.

If a bridge is available, the capacitors can be checked before installation, preferably on the same range of the bridge and preferably selected for accurate capacitance.

However, if you can't get three accurate capacitors, try to select three which are all under value by a definite percentage, or over value by a definite percentage—if necessary by adding some parallel values to one or two of them. The calibration control can then be used to make the appropriate overall correction.

If no bridge is available, the position will have to be assessed on the performance of the timer, after completion.

ACCURACY v LINE VOLTS

e voltage ariations	Test 1	Test 2	Test 3	Test 4
+10V	32.5	33	33	33
O	33.5	33	32	32.5
−10V	33.5	33.5	33	32.5
−20V	33	33	33	33

REPETITION ACCURACY

Nominal time	Observed Times Test 1	Test 2	Test 3	Test 4
1.41	1.4	1.4	1.5	1.4
2	2	2	2	2
2.83	2.9	2.8	2.8	2.8
4	4	4	4	4
5.67	5.7	5.8	5.8	5.8
8	8.2	8.2	8.2	8.2
11.31	11.5	12	11.8	11.8
16	16.2	16.2	16.2	16.2
22.63	22.6	22.6	22.6	22.6
32	32	32.2	32	32.2
45.26	45.2	45.2	45	45.2
64	63	63	63.1	63

tables show the performance of the timer, as checked manually against a stop c In all cases, accuracy is well ahead of normal photographic requirements.

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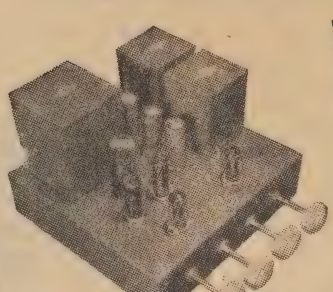

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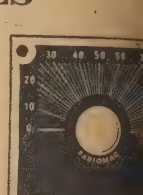

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Here's your answer, Tom!

Apparently Tom is a music lover who is seeking a speaker which would not dare to reproduce Spike Jones; at least that is what his first question seems to indicate. This and an assortment of other questions show that Tom has been burning the midnight oil in his quest for knowledge.

What is the best type of speaker an amplifier, to be used with mphonic music and giving per- t tone?

rst and foremost, Tom, speakers t choosy about what kind of signal are required to reproduce. As as the speaker is concerned, it ly has to respond to a succession ignal voltages which cause the to move backward and forward ifferent amounts and at different

nether the resulting sound is utable to Sir Thomas Beecham pike Jones is of no great con- nce. A speaker which will re- ce a jazz band properly will like- do justice to a symphony orchestra. t to specify "perfect tone" is an- matter. We take it that you mean "faithful reproduction" — thing that is not possible to achieve any speaker system. Room acous- methods of baffling and limitations peakers themselves all compromise nd result.

e best that can be said is that ers can be made which are capable

a long-haired speaker system.

iving quite excellent results and, eneral, their performance relates closely to their selling price. ere is quite a range to choose Small wide-range types, large range types, along with tweeters, e speakers and woofers intended used in combination.

e best we can advise, Tom, is you take the opportunity of listen- o as many amplifiers and speakers as possible—then buy one that you like and the best you can afford.

But forget the first part of your question, Tom. There is no such thing as a "long-haired speaker system".

What is the best type of baffle for a speaker, assuming a perfect amplifier?

You're overdoing this word "perfect", Tom, because, in fact, a perfect amplifier does not exist. If you take our word for this, we will go on to a discussion of baffles.

A "baffle", in the true sense of the word, implies a flat board the size of which is governed by the lowest frequency that you wish to hear.

As you may already know, a loudspeaker is a device for generating air pressure waves. These are transmitted through air to the human ear, as so many vibrations per second.

In its to-and-fro motion, the cone alternatively pumps and sucks air. There is a large displacement of air at low frequencies and cancellation occurs due to the air pumped by the forward motion of the cone, rushing around the edge of the cone to fill the partial vacuum at the rear.

Obviously if a longer path is provided, less cancellation will occur. The purpose of a baffle is to provide this longer path.

The ideal baffle would be far too large for convenience. As a result, a number of more compact methods have been devised to segregate the pressure generated by the back and front of the cone.

One of the most commonly used, and one which combines simplicity with efficiency, is the Bass Reflex Baffle or, as it is more commonly referred to, the vented enclosure. This is what we normally recommend.

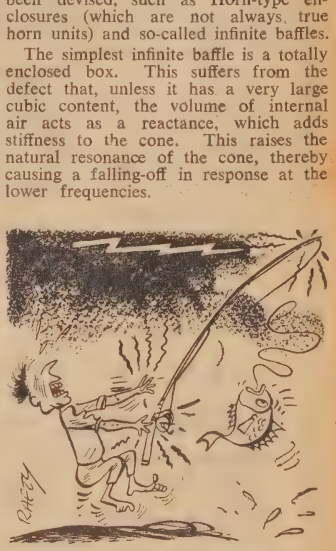
A properly designed vented enclosure imposes acoustic loading on the cone and prevents it from vibrating after the signal has passed. It allows the speaker to handle more power and helps prevent it from generating harmonic distortion.

A reflex baffle should ideally be so constructed that its internal resonance coincides with the natural resonance of the speaker. Cancellation then occurs, reducing the overall resonance to very small proportions.

Unmatched combinations of speaker and vented enclosure are quite frequently used since, with modern high quality amplifiers and their high degree of electrical damping, the speaker is less dependent on the enclosure for suppression of its fundamental resonance.

A number of other schemes have been devised, such as Horn-type enclosures (which are not always true horn units) and so-called infinite baffles.

The simplest infinite baffle is a totally enclosed box. This suffers from the defect that, unless it has a very large cubic content, the volume of internal air acts as a reactance, which adds stiffness to the cone. This raises the natural resonance of the cone, thereby causing a falling-off in response at the lower frequencies.



The ideal lightning conductor!

The largest practicable infinite baffle is provided when a speaker is mounted in a dividing wall, so that its front and rear radiations feed into separate rooms. Not everybody can arrange this, however.

Many other schemes have been hit upon, among them disused fireplaces, linen presses, cupboards, etc. These are chosen by virtue of convenience rather than performance.

Not one of these systems is perfect, Tom. Some are effective while others are merely convenient. We shall leave you then to weigh the pros and the cons, and make a selection.

In using a rectifying valve, with two plates, as a half wave rectifier, is it better to use one plate alone, or to join both plates?

The usual procedure, Tom, is to tie

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8M £2/16/6
12M £3/8/9
12O £5/-/3
12OX £9/12/6
12UX £23/4/1

HOMECRAFT'S *FAST* DESPATCH SERVICE

vo plates together but, if the valve operate under conditions specified ne half, it is not strictly necesto do so.

wever, if two full-wave rectifiers used as half-wave rectifiers in -wave circuit, the plates must be f one is to derive any benefit from rrangement. It would normally dopted only if one were seeking aw more current than could be ted from just one valve.

What is the most effective lightg arrester?

would say, Tom, a wet fisherholding a steel fishing rod, on the of a mountain stream, at the of an electrical storm.

es aside though, the real lightning er is a safety device, which is cted to the lead-in, between the terminal of your receiver and the

C ARRESTER

purpose of a lightning arrester is dge to earth any dangerous electrosurges due to lightning, and lessen ossibility of a major lightning dis within the receiver.

entially the arrester consists of lectrodes, separated by a gap of ximately one-sixteenth of an inch thirty-second of an inch. There f course, many forms of conon, the simplest consisting of the electrodes mounted on a bakelite nd provided with the appropriate als.

number of versions with refine- are also made. Among these type with a two-way knife switch, in one position connects the r to the aerial while, in the other n, it shorts the aerial to earth. y adding an extra measure of

another form of arrester, the des are made of carbon, and are ted by a perforated sheet of

xplain why cycles, watts, ohms, s, amps, are in the same wire, explain the meaning of cycles lectricity.

d your horses, Tom, or should y cycles, for what you require is k on the fundamentals of elec- commencing with the electron . However, we shall endeavor ighten you in the limited space ble.

ing copper wire as an example pper in it is basically composed of

SOLAR SYSTEM

h atom is made up of smaller es of which the electron is of iate interest to us. A number ese electrons, revolve in defined around a nucleus, very much like iature solar system.

he case of copper, these electrons, ularly those in the outer orbits, ry loosely bound to the nucleus nay migrate from one atom to r.

n electrical pressure or electro- force is applied between two in the wire, this electron travel eded up, the negatively charged ns tending to migrate toward the e potential.

migratory flow of electrons is d to as the flow of current. The unit of measure of this flow is the Ampere.

The unit of pressure necessary to create this flow is the Volt.

The ease with which electrons are dislodged from their orbits for free travel describes the conducting properties of a substance. Copper is a particularly good conductor.

In some substances, however, the electrons are very closely bound to their nuclei and a very much greater pressure is needed to create any mass electron movement.

These substances are known as partial conductors. In other words, they resist the flow of current, or that they have electrical resistance.

The unit of electrical resistance is the ohm, and it is necessary to have a pressure of one volt to force a current of one amp through a resistance of one ohm.

Cycles in electricity, Tom, refer to alternating current. Alternating current, as its name implies, continually reverses its direction of flow. It rises to a maximum in one direction, drops to zero, then rises to a maximum in the opposite direction and again drops to zero.

This complete rise and fall in one direction and then in the other forms a cycle.

The rapidity with which it does this is termed the frequency. This frequency is then referred to as so many cycles per second. The frequency of your mains supply, for example, is 50 cycles per second.

HIGHER FREQUENCIES

Alternating currents of higher frequencies are used for special purposes. In the electrical reproduction of speech and music, for example, frequencies ranging from about 20 cycles per second to about 15,000 cycles per second are involved.

In radio and television broadcasting and reception alternating currents of up to several hundred million cycles per second are used.

I would like an explanation for the markings on mica condensers.

The figures on a mica capacitor, Tom, denotes the capacitance value of the particular component. These values are fractions of a Farad, the basic unit of capacitance, which is too large for normal use.

There are two subdivisions of the farad, normally used in radio: The microfarad, which is a millionth part of a farad, and the micromicrofarad, which is a billionth part of a farad.

These are often abbreviated to mfd. and mmfd. respectively.

The term picofarad is also used and is a synonym for micromicrofarad, its abbreviated form is pf. These units are expressed in numerical form as whole numbers to denote micromicrofarads, or as decimals to denote microfarads, till unity is reached.

For example, 100mfd. could also be expressed as .0001mfd., or vice versa. 1000 mmfd. would be equivalent to .001 mfd. and so on. All local manufacturers use this system of marking mica capacitors.

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A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

IRCUITS USING A POINT-CONTACT TRANSISTOR

ansistor receivers have oused a great deal of interest nong radio experimenters. This onth we publish details of a ader's efforts to apply regen- ation to a transistor set. An ementary transmitter circuit is included for good measure.

. D. N. MORGAN, of Glencairn, R.D., Marton, N.Z., sends us an esting circuit of a transistor re- r, using an OC51 as a regenerative tor.

efly, the OC51 is point-contact type transistor.

int contact transistors have an in- t negative resistance and, accord- o the writer, the problem is to them from oscillating. This Mr. an achieves by including a variable or in the emitter circuit, which he s provides smoother control of eration.

keep the collecter current at about a 1000 ohm resistor is included en the emitter and the variable or. The 25 mfd by-pass condenser, the moving arm of the potentio- r, removes the noise developed by notion of the slider over the resis- element.

DING DATA

e coil used by Mr. Morgan is crys- t type, for which he encloses wind- lata. This is as follows: 80 turns)g. DCC wire on a 2½-inch dia- former, tapped every 10 turns. purpose of the taps is to enable ium aerial and base tappings to ound.

alternative circuit using a stan- commercial aerial coil (fig. 2) is ded.

. Morgan suggests that it may be ble to cover the amateur band, a suitably tapped coil that covers 0 metre band.

is also possible to improve the section, by the use of an OC71, to two OC72's in class B.

third circuit submitted, features C51 in a quartz crystal oscillator, he 80 metre band. Our reader s to have covered about 20 miles W and about 8 miles on phone.

one operation is accomplished by g a carbon mike in place of the resulting in quite heavy modula- of the carrier. To obtain the best t and to ensure that the crystal each time the key is depressed ned circuit in the base needs to be to the crystal frequency.

put is obtained from a tap on il, and it may be connected to a

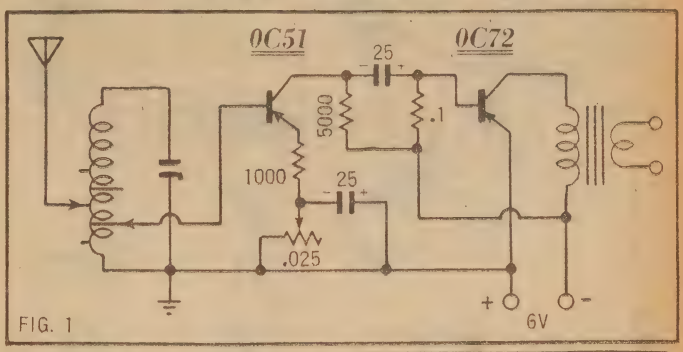


FIG. 1

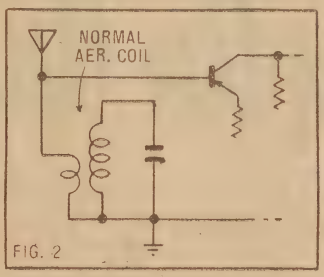


FIG. 2

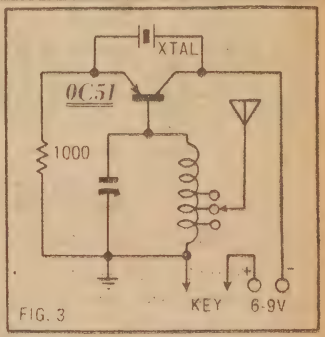


FIG. 3

Here are four circuits you may like to try. Note that junction type OC70 and OC71 will not work in place of the OC51.

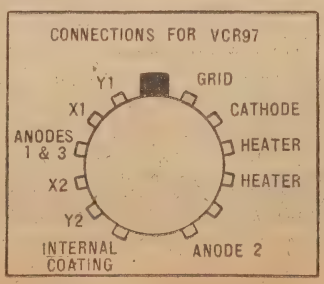
half-wave aerial, without putting the crystal out of oscillation.

As the leads on an OC51 are quite short and it may be risky to solder directly to them, Mr. Morgan made use of clips designed for acorn tubes. With care, it is possible to fit these on, without their shorting one to the other.

(The writer says that OC51 point contact transistors are readily available in New Zealand, being distributed by Philips. Limited stocks are available in Sydney at the time of writing. Ed.)

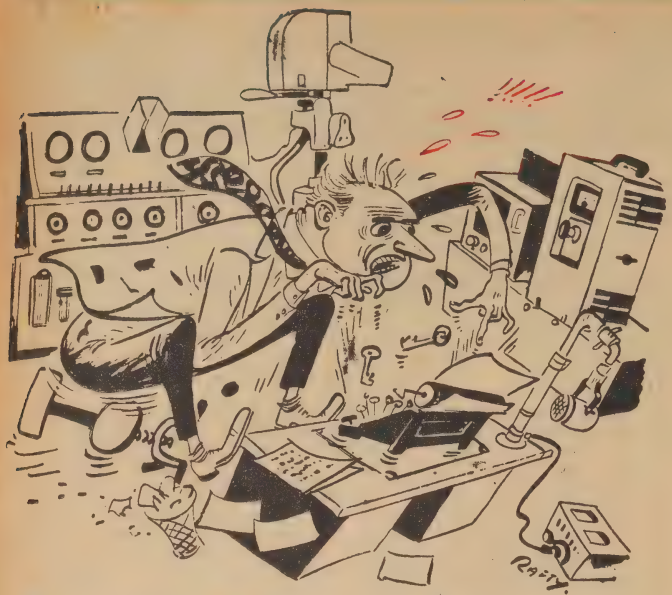
BASE CONNECTIONS FOR THE VCR97

THE VCR97 is an excellent 6-inch diameter cathode ray tube suitable for use in test oscilloscopes. The phosphor color is green but it could even be considered for use in experimental television receivers. It is available cheaply from disposals dealers and therefore will be of interest to many readers.



The base is a side contact type and a drawing showing the connections with the screen end away from the viewer is given here. The internal coating will normally be connected to anode 3 and returned to the EHT supply. Anode 2 should then be used as the focus electrode.

The heater is rated at 4.0 volts and 1.0 amperes.



Let's Buy An Argument

A reader from Kalgoorlie, Western Australia has struck a blow for all those of his fellow who haven't the chance to pick and choose amongst audio gear; who have to settle for certai pieces of equipment, largely on the score of price and their reputation generally. His mai worry is about loud speakers.

by Neville Williams

OUR friend says this and I quote:

"As an amplifier enthusiast I have been particularly interested in your articles on audio amplifiers, pickups, tone controls, etc and consider that over the past few years you have given them the full treatment. Any constructor who has kept up with his reading should be a full bottle on how to get the results he desires in regard to the above."

Then he goes on to point out that the speaker is generally the weak link in the chain and that the best of speakers are terrible in comparison with any respectable amplifier. After having experimented with quite a few he opines this way:

SPEAKER LIMITATIONS

"I am prepared to swear that any combination is only a reflection on whatever speaker is used. Your latest experiments have been with Ultra Linear EL37's. I consider this amplifier to be very close to the ultimate and will probably finish up building it some day, even realising that the whole set up is at the mercy of the speaker manufacturer.

Having thus established une raison d'etre, or whatever the French call it, our correspondent puts us on the spot. Again I quote:

"What I am trying to say is this. It is high time that you ran a series on speakers, with response curves for all makes and models that lay any claim to be a bit better than average.

"The specifications advertised by makers have no bearing on the performance, and they are no doubt too ashamed to publish response curves; and in any case what curves are published are open to doubt.

"I consider that a series on the above, covering tweeters and the new electrostatics, with recommendations re the use of full range speakers or dual and triple combinations would help to clear the air at the present time for constructors.

"Then, if the figures are in fav expensive imported types, I migh persuaded to "dig deep", and no blindly follow your usual advice, quote, 'Buy the best you can af to which I add, 'and hope for the

"Hoping that you can do some about the above in the near future extending my congratulations for a cellent publication.

Your faithfully, &c."

OPEN MIND

Just to show that he is an minded person, however, he enclo copy of an excerpt from "Sound cording and Reproduction", by ley Kelly, which seems rather to his own case. But more of that You can read the excerpt for yo in the panel opposite.

By way of initial comment, it is fectly true that we have referred i past to speakers as a weak link i amplifying chain and any one would be terribly perturbed if mea ment of our pet amplifier yielded kind of response we have grown t pect from speakers generally.

However, that isn't sufficient gr to give up the pursuit of better q and adopt an attitude that it's a

SIGNAL SOURCES

It would be impossible to make a statement if it were not true that orders of distortion which can occu regular signal sources — discs, pick tapes, &.—are sufficient to be appr over and above the limitations o unambitious 12in speaker.

The amplifier is another matter cause, by and large, the orders of tortion of all kinds in any self-res ing amplifier are much lower tha medium grade ancillary equipment.

I rather gather from our friend' ter that the speakers he has in min in the medium-priced, medium-q bracket. It may therefore be quite sonable to query the need for treme quality amplifiers.

But this isn't the end by any m The performance of modern high-q ancillary gear is now such that a s of time to bother about the input d and the amplifier system, particu the former.

I have often been impressed by clean reproduction obtained from ce pickups, discs or tapes played thr a very ordinary workshop speaker very ordinary flat baffle.

at the amplifier is warranted. De-
s are no longer willing to dismiss
ragments of distortion as being of
nsequence.
y are concerned about subsonic
ultrasonic effects, overshoot, inci-
instability, ringing and such like.
swing to ultra-linear circuits and
nodern techniques of square-wave
g are all in line with this opinion.
med listeners maintain that the
vements obtained are worthwhile,
given in the known limitations of
est programme sources, speakers
istening rooms.

D TO PROVE

this of course is material which
e the subject of endless and rather
clusive argument.
er all, if people claim that they
or can't hear a difference, there's
ne who can positively disprove
statement. One can advance rea-
(perhaps good reasons) why the
ons would appear to be wrong or
l but there the matter must end.
search workers haven't succeeded
establishing any definite relation-
between measured electrical per-
nce, and acceptability to that
variable quantity known as "the
er."
gineers can only do their best with
link in the reproducing chain and
stimate" what is or is not worth-

d, whether by delusion or other-
a lot of well-informed people,
expensive gear, have judged the
amplifier designs as being just

, of course, even allowing for a
r reference level, the problem of
peaker performance remains as a
real one. It's just part of the over-
roblem of converting electrical to
tic energy.
haps we should be a little more
e and define it as the problem
-constituting sound in a new and
unsuitable environment. In say-
his, I refer both to the listening
and to the attitude and preoccupa-
of the listener.
e design of a speaker poses many
ulties and it cannot be anything
than a compromise—a horrid
ht but true.
that compromise is slanted one
or another, then it is as much a
entary on the listener as on the
er designer (who is likely to be a
at heart). But because speaker
iers also have to eat, they must
ce speakers to formulas that appeal
rent tastes.

OMERS"

where, the Editor refers to the
arity in the US of speakers with
nant bass characteristic—to which
e not strangers here, either.
n speakers are easy to use, because
cone structure can be made quite
. They don't rely overmuch on
g and, given good suspension and
e magnet structure, they can sound
yimpressive. Therefore they sell
d.
akers designed to have no obvious
nce effects are not nearly so ro-
rely very heavily on correct baffl-
d seldom create such an imme-

"HIGH FUTILITY" . . . . .

We have now become accustomed to spurning any amplifier in which the total harmonic distortion is greater than one hundredth of one per cent of an oxybel. (*An oxybel is an inebriated decibel.) We also insist that the response shall be flat from DC to infinity, and that the power output shall be second only to the Battersea Power Station. We ask that the gramophone pickup shall have a negative playing weight; that it shall be able to handle accelerations of 100,000 G., and that resonances shall be non-existent. Beautiful my friend!*

GLOWING CLAIMS

We have lately been informed that loud-speakers in various guises give a response from sub-audible to ultrasonic frequencies, that the transient response is virtually infinite, and the reproduction is such that the mating call of the grass-hopper infallibly deceived the other sex.

Assemble the above equipment in the appropriate corner of your living-room and the result sounds, shall we say, a little less than perfect. In point of fact the other half of the household expresses her opinion somewhat more forcibly.

We were shaken to the core recently when we took some equipment which, like Potifar's wife, was beyond reproach, and did some objective measurements under domestic listening conditions. An insert microphone placed in the left ear of the victim (seated in his favorite chair) showed variations in sound pressure of plus 20 db over relatively short increments of frequency and this on a loudspeaker which had been tested in free field conditions not three hours previously, and had showed a perfectly smooth and resonance-free response.

Closing the curtains behind the victim considerably reduced the excursions, but simultaneously reduced the 10 kc/s level by 14 db; whilst rolling up the carpet and putting it outside the room not only restored the 10 kc/s level to its pristine loveliness but for good measure increased the level 6 db as well. Where do we go from here chums?

Seriously, this straightline perfection is undeniably the ultimate goal; but the long-haired ones who insist on this desirable perfection seemed doomed to disappointment under normal domestic listening conditions. On the question of harmonic and intermodulation distortion, the very air itself introduces considerable amounts of harmonic distortion at the high volumes.

The question then arises, when one listens in a concert hall to a crescendo resulting in a treble forte blast of sound whether the distortion introduced by the non-linearity of the air was intended by the composer, or whether we should possess some form of "acoustic negative feedback"—in short, to linearise this undesirable (?) condition.

NEW THEORY?

And this brings us to another rather important point. If one connects a loudspeaker (or for that matter any form of sound generator) to an oscillator, and has a switched attenuator, so that one can rapidly vary the volume while keeping the frequency constant, it will be found that the pitch of the note is a function of its intensity, although the frequency remains strictly the same; and the difference in apparent pitch, for a loudness ratio of 10:1 can approximate a whole tone.

The louder the tone the lower the apparent pitch. One can imagine Mozart turning rapidly in his grave as he listens to one of his Minuets, played apparently in a minor key because the unsuspecting gramophile has turned his volume too high.

diate impression. They are "better" for some listeners but not for others.

Then there's the old story of high frequency response. Some listeners want it at all costs, whether or not it may involve producing distortion along with it. They want to be startled, to hear the pips and the jingles!

Other listeners are much less impressed by such noises but they are acutely aware of distortions their fellows seem blithely to ignore. If a compromise has to be made, they want fewer frequencies with fewer harmonics, rather than more of everything.

And finally, there is the matter of output power. Some listeners want big noises in big rooms. Others want good noises in little rooms and their choice will be influenced thereby—I mean the kind of compromise they prefer.

Don't think I'm letting my imagination run away in all this. Before writing it, I deliberately checked through the situation with someone who sells a lot of high quality audio gear, of all makes.

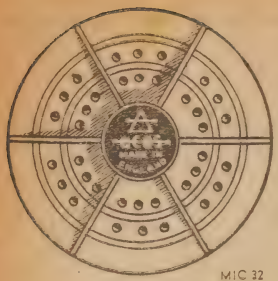
WIDE VARIETY

He assured me that there are ready buyers for husky, wide-range speakers; there are buyers for units with cones having a natural resonance so low that it scarcely counts; there are purchasers who can't afford an expensive speaker but who want highs and more highs; there are those who want high-grade but medium-range speakers and finally there is a ready sale as well for the small 8-inch wide-range types.

How could one possibly resolve a simple recommendation out of all this?

Of course, we could brush it all aside and say "let's be done with compromise."

"Let's have a speaker that will produce all frequencies evenly, that won't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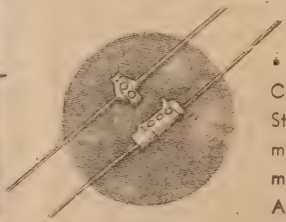

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odulate, that will be robust yet sonant, that won't be too demand- terms of a baffle, that will dis- its output over a wide arc, that andle plenty of power, that will &c.

yes, and it mustn't be more £10 odd . . ."

ther, when you find such a spea- et me know about it.

buy one, too!

correspondent from Kalgoorlie it sound delightfully simple with lk of frequency response.

it would be very handy to be o conduct such tests but I won- hether readers realise what they e?

e upon a time, it was necessary d the speaker with a multitude of requencies and read off the out- om a calibrated microphone chain, atory to plotting a complete curve. what a heartbreaking process it rying to record all the sawtooth es of the response.

re recently, the job has been done a synchronised motor-driven oscil- and automatic recorder—a nice ive piece of gear. This way a takes only a few minutes.

n you look at the curve.

begin to wonder what the treble se would be like at other angles e axis. You start to worry about l distances from cone to mic., er you have struck acoustic nodes oops; whether the room charac- s have intruded in the result. you spend a lot more time taking more curves.

CURVES TRUE?

n the bass end shows a droop you can attribute to the size of you had to use. Again you get d about room acoustics and the curve would look like if the r were mounted in the kind of ure that the manufacturer stipu-

you start building enclosures. And because it isn't convenient to trip to the country for a free field ou build a big anechoic chamber, won't be really good enough any-

you finally finish up with some imation of the speaker's fre- characteristics.

it's a very costly and compli- business to analyse a speaker's mance in terms of frequency re- —and it's only part of the story. peaker isn't a good speaker, just e it has good frequency response. at least equally important that not suffer from harmonic and/or odulation distortion.

check this, the same facilities are ed as for the frequency run but dditional expensive equipment.

do the job properly, individual nics have to be measured at as check frequencies as possible and ying amplitudes.

a long and wearisome task.

n you've finished all this, you handful of papers—frequency e curves, polar diagrams and nic analysis at spot frequencies.

n these, you have to make up r mind whether this speaker, with e like this and that, will be bet- n another one which has superior response but higher distortion, or vice versa, or one which looks generally better except for a nasty something just here — or there!

Again I'm not romancing. That's precisely the position one arrives at.

And it's precisely the reason why hard-headed speaker designers adopt the attitude that you should listen to speaker first and decide whether you like it. After that, if facilities are available, you try to analyse its performance on a quantitative basis and improve on it where you can.

That's the horrible part of it. After you've analysed a speaker electrically (involving a great deal of time and equipment) there lacks any definite relationship between what you have measured and what your ears like or dislike.

Our friend from Kalgoorlie says he doesn't believe the response curves published by speaker manufacturers. We aren't in a position to draw them, for lack of time and facilities and we have cast doubt on their value, anyway.

Is there any justification, then, for our reference to price?

Well, we had another look at this and we think there is. Does the following sound logical?

BETTER AND BETTER

Let's say you want the conventional kind of reproduction. You can buy a standard Magnavox, Rola or MSP Jensen 12-inch fairly cheaply. By paying something extra, you can get a version with a larger magnet and possibly a different cone, which will give you wider response, higher sensitivity and better power handling capacity. That's something for your money.

If you're prepared to go to a higher figure again, you can get a speaker like the Goodman's Audiom 50, with a curvalinear cone and rather more ambitious performance figures. Pay over still more and you can get a larger version with all the sensitivity and power handling capacity that you're ever likely to need.

But let's say that you want wide range from your speaker as a first requirement. You want to hear the clicks and the jingles.

Well then, you can start down in the lower price bracket again and take your pick of the twin-cone Magnavox or the Rola 12OX. If you can afford a bit more, you can combine the wide range with better power handling capacity &c. by buying say the cheaper Goodman's twin-cone speaker or the Rola 12UX.

NO END TO IT

But when you've come this far, involving a retail outlay of £25 or more, you may start to look on to the Axiom 22 or the Barker Duode or the Wharfedale 12CSAL, retailing up around £40. By and large, performance will follow the price.

If you can't go to these figures, and want fidelity on a more compact and economical basis, there are the imported 8-inch wide-range types I mentioned earlier retailing at about £14.

And if your fancy turns to multiple speakers, you can start off with an MSP Jensen pair for about £9, or a more expensive pair which is shortly to be released at about £16.

But you could reasonably expect still better results from a combination of the more expensive speakers mentioned earlier or, better still, from Wharfedale's well-known 3-speaker system. But this latter will leave quite a large hole in your cheque account.

Nor is that the end. A 15-inch woofer in a big enclosure will generally do better at the bass end than a smaller one but it will cost more, because of lower demand, higher production cost, bigger frame and magnet and so on.

In all, I feel that our suggestion of buying the best you can afford is reasonable advice—provided you make up your mind beforehand as to what you want in the way of reproduction.

ABOUT RESISTORS

Following on my remarks last month about preferred values of resistors, a reader comments about his own experience. Planning to build one of our Playmaster Control Units, he counted up all the resistors, made some kind of a calculation and ordered them by post from his usual supplier.

The resistors duly arrived, along with a request for more dough (in polite terms, of course). Enquiry elucidated the fact that this firm charged more for certain of the resistors because they were NOT preferred values. They were merely very conventional values, like 20,000, 30,000, and so on.

I rather gather also that business in resistors is fairly brisk at the moment, particularly in these same preferred values. It comes from radio establishments who are setting up TV service departments. Maybe they can't get all the personnel they would like; maybe the instrument position is a bit sticky, but at least they can buy in stocks of replacement resistors—and capacitors, I suppose.

Perhaps we had better watch out in future that we don't specify an odd resistor in our circuits that doesn't conform to the preferred system. We had better buy in some new stocks ourselves.

And speaking of television, as I write the first test transmissions are going out over the Sydney station TCN. Already there are reports of "DX" reception from odd receivers around the countryside.

Apparently usable to good signals have been received in places like Wollongong and Cessnock, ranging between 50 and 100 miles from the transmitter. This is on Channel 9, up near 200Mc. I can imagine that quite a few folk in the closer country areas are going to receive a pleasant surprise when the National stations go on the air, using the lower frequency channels.

Conversely, certain other folk will be in for a surprise of a different nature —particularly those who have sought out and built in romantic, bushland settings, nestling 'tween towering crags.

One such gentleman of my acquaintance took home a receiver recently to see whether he could get TV signals in such a place. He certainly did. In fact, he is now getting five signals, one from each of the neighboring hills and headlands!

When I last saw him, he was struggling home with an armful of Yagi elements.

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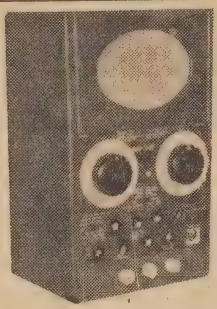

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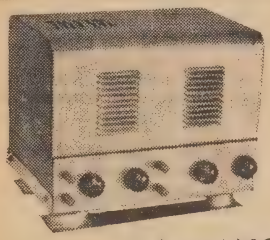

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FROM THE SERVICEMAN WHO TELLS

fter last month's discussion of television and its many problems, it might be as well if I least started this month with a couple of incidents which are about as simple and common-ace as any which a serviceman encounters. After all, it is perhaps just as well that service jobs aren't all hard ones!

first job happened right in my wn home but, contrary to the old about the plumbers' taps always ng, &c., I had to attend to it ith. My wife—or the XYL, as ams say—saw to that!

short, I was greeted the other g with the news that the set topped—"the set" being a small mantel job which normally lives kitchen.

wife explained that she had taken of the cabinet, pushed all the s and things" but it still wouldn't

GOOD PRACTICE

owned on this because, quite h, I'm not keen on the idea of taking sets out of cabinets and ng at things". The combination steel knitting needle or a bobby d a couple of hundred volts can ngerous for the person concerned ngerous for the set, too, if it's to the floor midst the ensuing tion.

for the sake of a few serials!

ointed out that such measures necessary because, after all, was still a perfectly good radio-in the living-room—one with a nge amplifier, high quality and . . . er . . . er . . .

What's the use? Who'd expect a , anyway, to appreciate such What if it does have a few ontrols?

, I switched on the offending set and noted that there was no g in the rectifier and no obvious or smoke from elsewhere. So good.

the volume control turned up he set sounded quite dead at t, as I turned it across the band, just hear the stations coming Apparently the tuner was g but the audio end was dead.

ng the set over, I picked up the Mecanno screwdriver and went into the works. The retort was ate.

look. You tell me not to prod into a set because it's dangerous . . . and you're doing it with a metal screwdriver."

The fact that I knew where I was prodding, that I had my free hand well away from the chassis and was standing in dry slippers on a dry carpet was lost on my critic.

I was prodding, wasn't I? That's all there was to it.

Ignoring the interruption (which was about the only possible course anyway), I prodded quickly between the 6V6 output screen and chassis. The resulting fat spark had its own effect on the conversation (or should I say mono-logue) and also indicated that the high tension voltage was present.

Next, a brief prod, then a longer one, between the 6V6 plate and chassis produced nothing at all; no spark, no plop in the speaker.

It was clearly a case of an open-circuited output transformer.

JOB FOR TOMORROW

I, therefore, switched off immediately and pushed the set aside for attention next day. After all, who wants to spend his evenings repairing radio sets, especially his own?

Actually, I might have spotted the trouble without resort to a screwdriver but for the fact that the 6V6 was completely coated inside with aquadag, or whatever the black coating is that manufacturers so often spray inside valve envelopes.

When a speaker transformer becomes open-circuited, no volts get to the plate and all the cathode current flows to the screen. The screen, not intended to dissipate as much power as this, forthwith becomes red hot and may perchance release gas, thereby sending the valve "soft".

Once upon a time, a red-hot screen in the output valve was as plain as a traffic light but, nowadays, with black coating inside the valve envelope, miniature construction and such like, it isn't nearly as obvious.

But, for all that, one doesn't leave a set switched on with no volts applied to the output plate. It just isn't good for output valves.

The second incident I have in mind was rather like the first in its general setting, except that it concerned a close friend of the family, living nearby. The dear lady couldn't listen to anything; she was all on her own.

"Couldn't I slip along and just see if I could help her?"

I was tired; I had other things to do; I had my slippers on; I . . . er . . . er . . . Yes Dear!

The set was another 5-valve mantel job of well-known make. The good lady explained that it would be going normally when all of a sudden it would make the most awful noise and she was afraid now even to switch it on.

Well I switched it on and, a few moments later, in came the signals but no awful noises. Surely not an intermittent!

Let's try bumping the cabinet. Bang!

Next moment I was grabbing for the volume control to eliminate the most unearthly howl. When that didn't stop it, I had to grab for the power switch instead.

IN AUDIO SYSTEM

I had heard noises exactly like that from a faulty converter valve but this was obviously after the volume control.

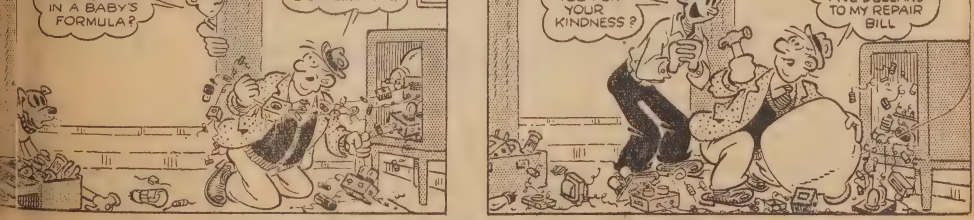
Dutifully, I tucked the set under my arm, went home and took it out of the cabinet. This time, I switched it on and bumped the first audio tube, a 6SQ7-GT. Again it howled obligingly and violently.

Must put in a new valve. Now let me see. I was certain I had a 6SQ-7GT in stock.

But I didn't have one; it was Friday evening and it looked as if milady wouldn't have her favorite sessions till the following Monday. But wait.

Remembering an old trick, I bumped the valve several times, base down, very firmly on the table. Then I bumped the top firmly into the palm of my hand and plugged the valve into the set again.

It was as docile as could be. No further amount of bumping would produce the howling noise complained of.


DID YOU EVER HEAR OF PUTTING CORN SYRUP IN A BABY'S FORMULA?
SURE, THAT'S GOOD. I KNOW, I RAISED EIGHTEEN KIDS
HOW CAN I EVER THANK YOU FOR YOUR KINDNESS?
OH, THAT'S OKAY-- I'LL JUST ADD FIVE DOLLARS TO MY REPAIR BILL

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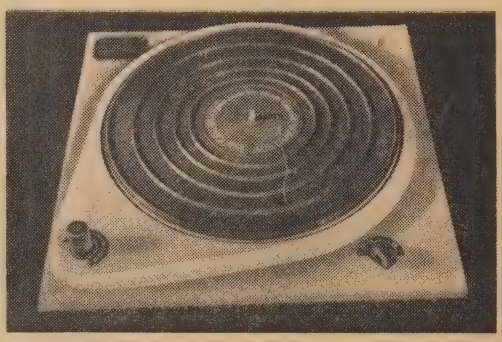

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- ★ **Induced hum is vi ally non-existent.**

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INTERSTATE TRADE INQUIRIES: **T H. Bentley Pty. Ltd., 1092 Mt. Alexander Road, Essendon, W.5. Victo Factory representative for N.S.W., Qld., S.A., W.A., Tas., & New Zeal**

Manufactured by Orpheus Sound-Reproduction Equipment Pty. Ltd., Melbourn

ip that a tiny scrap of foreign mat
had lodged between the grid and
ode, causing a partial short and the
ing effect which had originally been
plained of. When I bumped the
l as described, it simply dislodged
particle and restored the valve to
al.

Ie struck this trouble several times
t valves like the 6SQ7-GT and
G, which are high-mu types having
ry fine grid wound close to the
de.

course, it could have been a faulty
which my bump treatment closed
ut I don't think so. Faulty welds
usually cured as positively as this
Nor as permanently. As far as I
, the valve is still going okay. Cer-
I haven't heard any more com-
s about it.

r did I make much money out of
ob. But then, as I've mentioned
e, even radio servicemen aren't
doing an occasional good turn for
friends.

d, finally, just to conclude this
tation on simple things, I can well
from a letter which I received
g the month from a serviceman
l. After a period of working in
ey, mainly on receiver production,
as gone back into the servicing
in the Brisbane area.

FICE IN QUEENSLAND

Fre's what he has to say:

*ice last week I have been working
uburban electrical shop as an elec-
diagnostician." (My friend has a
tir sarcastic nature.—Serviceman).
ent job, you meet a lot of people.
dee a lot of derelict radios.*

*e most common question you en-
wer is: 'My radio has stopped. How
e do you think it will cost to repair
his over the telephone, mind you.
ou tootle off to the place, have a
ol at the set, remove it from the
nr, plug it in and switch it on. It
rks.*

*s, you're dead right! The mains
fell out of the socket."*

*believable, but this happens four
n in a week.*

*nwever, whilst they do get on your
ves, they are comparatively harmless.
to another set I had a look at and
i had stopped. Went through the
ue and then reached for the volume
ol. No knob. The next thing I
mber is collecting myself from the
pite corner of the room.*

*"Oh yes,' the customer says, 'I
nd you to put a knob on that, you
et quite a nasty shock off it.'*

" u're telling me!

*"nother cove blew all his fuses, when
ied to attach a good earth to the
es on a set like this one.*

*"u have guessed it—an AC-DC
orrosity. They tell me about one a
e comes in for repair, so there must
lbe a lot of them around. See
ane paper for my funeral notice."*

Vll I hope not but, brother, I know
you feel!

Bore going on to discuss my next
di fault I am prompted, once again,
r.ke some comment about the grave
k many people seem prepared to take
th their electrical appliances; either
rom ignorance or a general "don't-
re attitude. The story hinges around a remark made by a typical housewife concerning an equally typical domestic electrical set-up.

It started when the lady came into the shop to collect a portable she had left for overhaul. She had brought with her a simple appliance cord — from her iron, I think — and asked me if I would fit a new three pin plug. It certainly needed one, the original apparently having been trodden on.

While I don't go looking for jobs of this kind as a rule, I generally undertake them when requested — more to oblige the customer and maintain goodwill than anything else.

SAFETY TALK

She waited while I fitted a new one and the conversation naturally turned to safety matters and the need to maintain cords and appliances in good condition.

"I'll have to do something about the cord on my sewing machine," she remarked, "it's been rubbing against the wheel and the rubber is almost worn through."

The remark came as something of a shock, not only because of the implications, but also because of the casual manner in which it was made. She might just as easily have been discussing the need to buy a new tube of toothpaste for all the urgency there was in the remark.

Sensing that she may not have been fully aware of the consequences I hastily urged her to have the cord replaced before using the machine again. Then came the punch line: "Oh, it's not dangerous really," she replied brightly,

"It doesn't seem to play up when you're around." ("Radio-Electronics")

"You see, a sewing machine uses very little power".

For a fraction of a second I thought she was "having me on." Then with a jolt I realised she was quite serious. Even then I found it hard to believe that a person could make such a potentially gruesome mistake. Yet there it was; she sincerely believed that the danger of an appliance was directly related to the power it consumed!

Small wonder that my jaw dropped and it took me several seconds to regain my speech.

When I did I concentrated all the eloquence I could muster in an effort to impress on her the fact that the amount of current consumed by the appliance was of little importance; that it was the power consumed by the victim that mattered!

I don't know whether I succeeded or not. As I hinted at the beginning of this article, women are funny creatures. Once they get an idea into their pretty heads you will be clever indeed if you can get it out again — no matter how wrong it is or how much logic you apply.

MIS-INTERPRETED

In this case it seemed she was basing her belief on a statement by some acquaintance in whom she had implicit faith in matters electrical. As far as I could gather he had said something to the effect that it was dangerous to use certain appliances from a lighting socket because of the amount of current they consumed. (He probably also had in mind the absence of an earth wire, but made the other point on the score of simplicity.)

I have no doubt that the statement was a perfectly correct one in the sense that he intended it. It is obviously dangerous to connect heavy duty appliances to a lighting circuit intended to carry only five amps. The result will be a blown fuse, or overheated wiring if some "smart" individual tries fitting heavier fuses. This, I imagine, was the type of "danger" referred to, but my customer, woman like, construed it to mean danger to the user in the event of fault in the appliance.

Which just goes to prove how carefully one must phrase one's statements — well to the womenfolk, anyway!

While this is a particularly striking case—and for that reason it prompted me to comment—there is a large section of the community with similarly incorrect, and dangerous, ideas. In general it boils down to a strange idea that the voltage available at the mains is not really dangerous—at least as far as they personally are concerned. In other words they are convinced that it can't happen to them.

USE FAULTY APPLIANCES

As a result they continue to use appliances which are obviously faulty, even to the point where they have received shocks from them. Because the shock was received in circumstances which prevented it from being anything more than a tickle they imagine that nothing worse can happen and that they are perfectly safe.

One classic example was related to me by a colleague. It concerned a refrigerated display counter in one of his local shops which had apparently developed some kind of fault, causing the frame to become alive. This was bad enough in itself, but was made even worse by the presence of a second counter, featuring the usual display of chromium plated metal strips, adjoining the first.

Apparently the metal strips were quite effectively earthed and anyone leaning with one bare arm on each counter would "cop the lot". The reaction was quite violent, suggesting that something like the full mains voltage was present between the two.

Yet the shopkeeper regarded it merely a mild inconvenience and took no positive action beyond remarking that he would have to have it fixed. Had he but realised it, the victims were prob-

THE BJ ARM

Technical Report by P. WILSON, M.A.:, *quoted from* THE GRAMOPHONE:

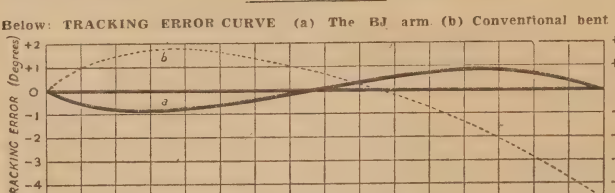
It is beautifully made, and indeed is an example of precision workmanship. Notwithstanding the four extra pivots, the lateral motion is without play and as sleek as velvet.

In addition, stylus wear will be reduced and becomes more of the nature of a polish, not only by the better seating of the stylus in the groove but also because it will now track with reduced pressure. This in its turn will decrease record wear.

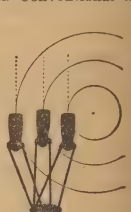
These virtues are not mere theoretical deductions. They are readily observable in test conditions. In particular, the crispness of the response, especially in the bass, and the increased articulation and resolution of different instruments in orchestral records are easily discernible. . . .

It will be gathered from all this that I am enthusiastic about this BJ Arm. I am indeed. It is certainly the most satisfactory swinging arm that I have ever seen.

Below: TRACKING ERROR CURVE (a) The BJ arm (b) Conventional bent arm.



INCORRECT TRACKING with Conventional Arm.



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Valves: As 931-15.
19% Screen Taps.

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Resp.: As for 916-15.
Valves: As for 916-15.
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only saved from being seriously not fatally — injured by the nate fact that there was no part ther counter of such a shape or that would permit of its being ed. Thus the reaction simply the victim clear. But what a hat shopkeeper was taking!

e fact that many shocks are rela- mild appears to be the cause of attitude, and many people take a of convincing that anything more is can happen. How they recon- his attitude with the fact that fatal ents do occur is a question I can't er. I can only suggest that, like oman customer, they imagine that ature of the appliance has some- to do with it.

LL DEPENDS

me to think of it, such people ly refer to a particular type of ance as being dangerous, rather to the mains voltage in general.

ether a shock from a faulty appli- is slight or serious is, of course, y a matter of circumstances. The has to make contact with the side of the circuit in some man- and this is usually the nearest ed object. Should there be no ed object no shock will be felt. earth is poor, the shock may be

the earth is good the shock can be and, if the victim has a good on the appliance the resultant ular reaction can easily be so ht that he cannot release his hold. s help is to hand the result is ally fatal.

e earthed object can be the floor hich he is standing should it be as in the case of concrete, or the itself when working out of doors. er shoes will provide a measure of tion if they are quite dry, but this dom so. Bare feet on damp earth worst possible condition.

er hazards are water taps and or any other eathed metal object, ularly if small enough to be ed in the hand. This latter point ite important because an other- dangerous situation may do no than throw the victim clear if is nothing small enough to grasp.

AT CAN YOU TAKE?

d while on the subject of shocks, many volts do you imagine you tolerate before experiencing dis- ort? 20 volts? 50? 100 perhaps? is recently privileged to witness nteresting demonstration in which nber of volunteers submitted them- s to a simple test.

ey were given a couple of metal es, told to hold one in each hand, the operator slowly increased the ge from zero until they asked him op. Apart from a volt or two th way they all cried "enough" at olts (yes, 20) and described the tion as approaching involuntary ular contraction.

case you're inclined to snort "sis- s and recall the number of times have "stopped" several hundred from a set or amplifier, let me n to assure you would have fared etter than the fellows I have de- d. The secret was the manner of ation; the large metal handles which made such effective contact with the skin.

Since these accurately simulated the condition where a victim has a faulty appliance in one hand and a water tap in the other, and everyone was distressed at a mere 20 volts, it is not hard to imagine the effect of more than 10 times that amount. The condition where the victim is standing on a damp floor may be less hazardous than this "ideal", but only slightly so. In terms of results there is often no difference.

By contrast, the shock you experienced from the HT line of a receiver was probably only applied to the tip of the finger. The result was little more than a tickle.

And, finally, here is an account of an incident I witnessed after I had written the above comment. I was visiting a business acquaintance in his city office and arrived about the time of the conventional morning "cuppa".

BOILING THE BILLY

While we talked, a couple of lasses in the outer office were busy with an electric jug, a teapot, and the rest of paraphernalia required for the ritual. The rattle of cups and saucers and the spluttering of the jug provided a pleasant background to our conversation.

The peace was suddenly shattered by a loud, juicy "splat"—the kind which is quite unmistakable — followed by a girlish squeal. Instinctively we both rushed for the outer office and I tried to remember all I know about artificial respiration. Fortunately it wasn't necessary, but the set-up before us was bordering on the fantastic.

On the table was the jug, silent now, and minus its lid. Standing nearby was one of the lasses with rather a sheepish look on her face and holding in her hand an aluminium teapot. The cause of the sheepish look was two holes in the rounded portion of the teapot between the side and the bottom. They were about an inch apart and, roughly, an eighth of an inch in diameter, though rather irregular in shape. They were both blackened around the edges.

PART OF THE RITUAL

In reply to the inevitable question the girl explained that she had placed the empty teapot over the top of the jug to warm it. (A procedure, I am given to understand, which is known in housewifely circles as "hotting the pot".) The result was "that funny noise", followed by the failure of the jug and, we now realised, the radiator as well.

With the jug disconnected the girl showed us exactly what she had done, resting the teapot on the jug at a rather odd angle. It was easy to see what had happened. The two pins forming the plug passed through the side of the jug only about ¼ inch below the rim where they were secured by nuts and which also held the two brass rods running to the bobbin.

The teapot, by reason of the odd angle, had sat fairly on top of the two pins, placing a dead short across the mains. In the fraction of a second before the fuse went the current had punched the two holes in the thin aluminium wall.

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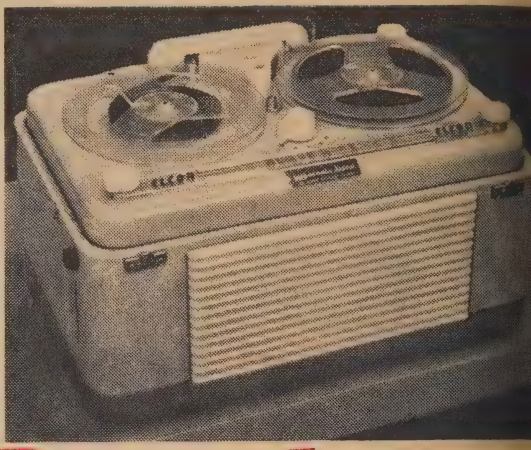

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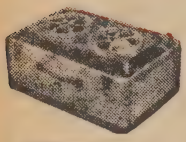

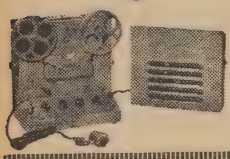

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MAGNETIC SOUND INDUSTRIES

GEORGE STREET (OPP. STRAND ARCADE) ON THE 1st. FLOO

PHONE: BX4440-BX4586

ngely enough, the lass seemed worried by the ruined teapot than ct that she might have been kill- n fact, I don't think she was by leans convinced that this was so. ertainly didn't attach any im- ce to the fact that the jug was t a lid. In answer to her boss' n she replied rather vaguely that ought it "was around somewhere". ntly it had come off at some time o one had ever bothered to re- it.

SUICIDE

afraid I shuddered inwardly at ole set-up. The idea of operating without a lid is completely con- to regulations—as well as one's n sense—by reason of the un- ed element in the water. It is is reason that jugs are invariably so that the appliance plug cannot nnected until the lid is closed. m afraid the designer reckoned t the stubborn tenacity of the e office worker.

ken lid or not, this one was going e her cup of tea—even if it killed

unately the boss had no illusions the situation. When I left he was ing to the effect that the lid have to be found; otherwise the as going to meet with a nasty nt.

nly hope, for everybody's sake, esn't weaken.

so back to the service bench. bst interesting case I had this was that of a car radio, if only e of the number of faults in- e.

owner, one of my regular cus- e, had been complaining about the some time, generally along the hat he must get me to "have a at it sometime", but without any specific request for my ser- I gathered that the set was ning but suffered from poor gain, noise, etc. I also imagined e was putting off the inevitable it worked well enough to get a cal stations.

TABLE

is not surprised, therefore, when ked into the shop one day with under his arm. "It's happened," ned. "The thing's gone completely . Better give it the works while e it out of the car."

reed that this was sound policy wardly blessed him for taking of the car himself. Maybe I'm old and fat, or cars aren't as they used to be, or perhaps its but I seem to find it harder to yself behind the dashboard every try.

way, I set the receiver up on the and connected it to the six-volt . The result was a rather dis- noise from the vibrator and, fter the valves had warmed up, ttle else. A quick check showed ere was no HT, suggesting, along e noise from the vibrator, a pos- hort in the HT line.

ching off, I checked with the meter. Sure enough there were about 200 ohms from HT to . Then the fun started. I had ope of isolating the trouble with- mporarily disconnecting various filter and by-pass capacitors from the HT line, but this normally routine procedure proved to be anything but that.

Echoing the pleas of many of my fellow servicemen I ask the manufacturers: Why, oh why, must you insist on twisting every lead about three times around the lug? Do you really believe it is essential, or is it just one of those fads which somebody dreamed up years ago and which has been slavishly followed ever since without anyone knowing why?

Frankly, I don't believe it is essential. I have encountered a lot of mobile equipment in one form or another over the years; some of it regular gear, some of it developmental and exhibiting plenty of weaknesses.

TYPICAL TROUBLES

I have seen transformers and chokes pull holes in flimsy mounting lugs; I have seen chassis collapse under the continual pounding of a heavy transformer; I have seen innumerable examples of nuts and bolts which shook loose in a few hours because of inadequate locking devices; but I have yet to see a properly made soldered joint —without the need for twisting—which has succumbed to such vibration.

As a matter of fact, it is invariably the pigtail which fails first if the component is not firmly anchored, the soldered joint being stronger than the wire. In such circumstances it seems quite pointless to indulge in this practice, particularly when it is so objectionable from a servicing angle.

Any serviceman will know what I mean. You suspect a particular component and decide to lift one end of it for testing. But both ends are hard to reach and the twisted leads mean you have to get a pair of pliers or the blade of a screwdriver under the free end of the wire, at the same time keeping the joint molten with the iron. You usually finish up cooking several adjacent components, breaking the lug off a valve socket, and scattering solder into a lot of vital places. Even then the joint is probably still hanging like a loose tooth.

RUIN COMPONENT

On the other hand, if you cut the lead you will invariably find that the component tests OK but has to be discarded because the lead is now too short. Either way it is a most frustrating business.

Maybe the above remarks will bring the wrath of some manufacturer about my ears; I half hope it does, it may stir them into thinking about the matter a little more.

Anyway, this was the situation in this set. Every time I tried to isolate a component or a part of the HT line (which wasn't particularly easy to trace anyway) I came up against this aggravating situation. By the time I had found the fault I was ready to boil somebody in oil.

And what was it? Oh, yes, I nearly forgot. A breakdown between pins 6

(Continued on Page 113)

ULTRON 15 series

TAPE HEADS *Extraordinary*

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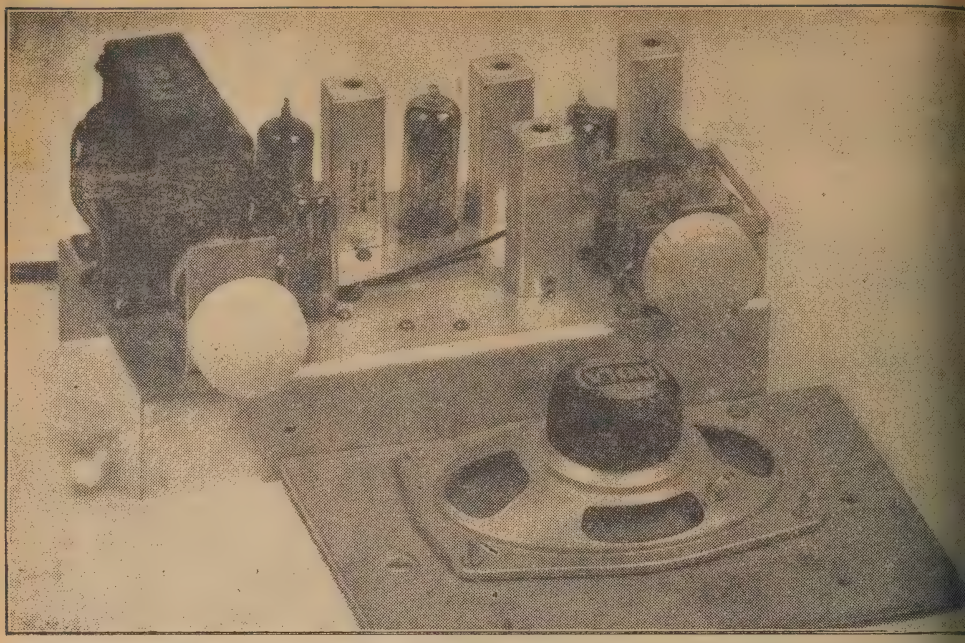


The complete chassis ready to take the speaker. The aerial coil is behind the tuning capacitor and the oscillator coil to the l
Note the lead from the front section of the gang passing through the hole in the chassis.

THE "LITTLE GENERAL" FOR 195

We rather imagine that those of you who have completed last month's section have bee champing at the bit in your eagerness to get on with the final stage. Well, we hope the wait ing has not been too irksome, and here it is. If all goes well you should be listening to th local stations a few hours after securing the remaining parts.

By PHILIP WATSON

BUT first, here is a brief summary of what we propose to do and the manner in which this part of the circuit functions. It should help to make your task a little more interesting and you will not be merely following instructions blindly; without a clue as to what it is all about.

Last month, you will recall, we introduced the idea of the superhet; the principle of reception whereby each incoming signal is changed to the same frequency, known as the intermediate frequency, in order that we may obtain better selectivity and sensitivity.

This month we are to wire that part of the circuit which takes the incoming signal and converts it to the new frequency. It is, in fact, referred to as the "frequency converter stage."

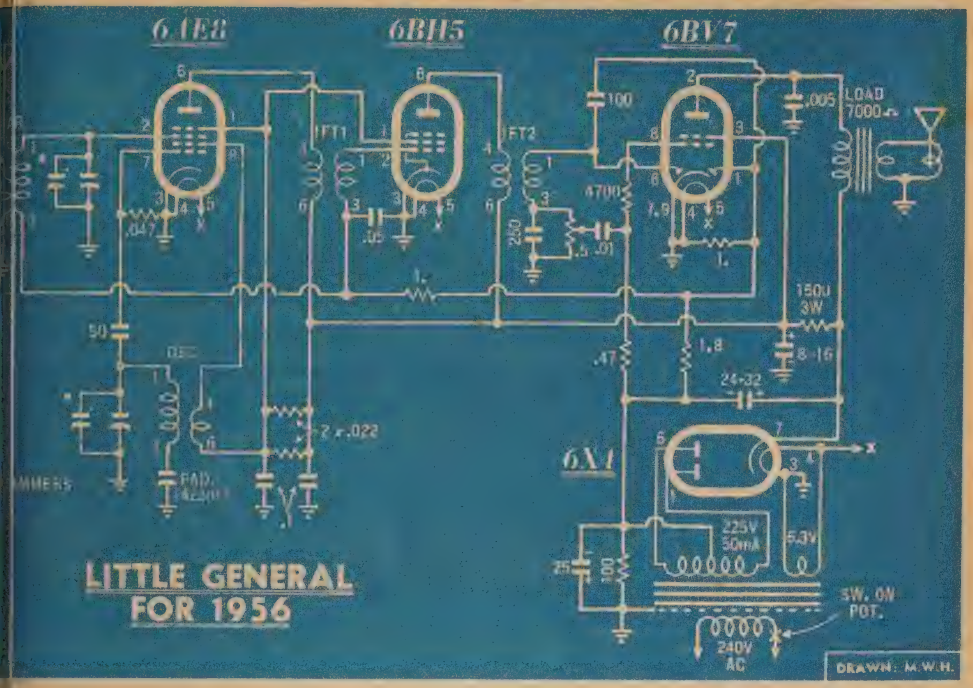
To understand how this functions, it is first necessary to appreciate that the 6AE8 is really two valves in one, a triode and a pentode. Assuming a common cathode (pin 3) for both, the first and second grids (pins 7 and 8 respectively) form the grid and plate of the triode. The third and fourth grids (pins 2 and 1) plus the plate (pin 6) form the signal grid, the screen grid, and the plate of the pentode section. The suppressor is connected internally.

Now let us look at the circuitry associated with the triode section. Ever seen anything like it before? Ever studied the circuit of a regenerative detector? If so you can probably recognise the similarity between the two. There is the tuned grid circuit, the feedback coil in the plate circuit, the grid resistor or grid "leak", the grid coupling capacitor, &c.

As with a regenerative detector it is only necessary to provide sufficient coupling and the circuit will oscillate continuously, and this is exactly what we do. The frequency at which it oscillates is determined by the constants in the grid tuned circuit and can there be varied by varying the tuning ca tor. The whole circuit is referred t the "local oscillator".

On the other hand the pentode se is concerned mainly with the inco signal. This has already been selecte some extent by the aerial coil and as ated section of the tuning capa though, naturally, a single tuned ci will not provide a high order of s tivity. This signal is applied to signal grid (pin 2).

Now an interesting phenomenon curs. The operating conditions o pentode section have been so sel that the incoming signal and the oscillator signal are "mixed", i.e., bined in such a manner as to produ third signal having a frequency to the difference between them. (A nal equal to the sum is also prod but we are not concerned with th the moment.)



Complete circuit showing the extra parts and wiring required this month. Refer to last month's circuit and remove temporary connections before commencing the final stage.

his stage a typical example will y help to make things clear. n an incoming signal is on exactly k. If, now, we provide a local or signal with a frequency of c there will appear in the plate of the 6AE8 a signal having a ncy of 455 Kc. — or the differ- tween 600 and 1055.

I.F.

by a happy chance, the IF mer in the plate circuit of the (IFT1) is tuned to 455 Kc and so s this signal on to the following - the 6BH5 — while effectively ig all other signals.

ou have probably guessed, the chance we refer to is really no ing. We deliberately arranged e local oscillator would be of frequency as to produce a 455 erence signal. Similarly, when in to receive a signal on 700 Kc. al oscillator will be set 1145 Kc., roducing the required difference

e process continues right across adcast band, the local oscillator always 455 Kc. higher in fre- c than the station required.

e same time we must arrange aerial tuned circuit to be exactly to the actual station frequency us provide a certain amount of ection" before the mixing pro- kes place. The easiest way of his, from the designer's point of view, would be to provide a separate tuning capacitor and dial, for the aerial and oscillator circuits. Then the aerial could be set to 600 Kc while the oscillator was set to 1055 Kc.

But such an arrangement would not be convenient from the user's point of view and it is very desirable that both tuning capacitors be operated from the same dial. Hence the two-gang tuning capacitor. Unfortunately, it isn't quite as simple as that, because the two sections have to perform two quite different jobs. The local oscillator has not only to operate at a higher frequency than the aerial circuit; it has also to cover a different frequency ratio.

TRACKING

These two effects are obtained, using identical tuning capacitors, partly by selecting the correct value of inductance for the oscillator coil and partly by "padding" the circuit with a certain amount of series capacitance. Hence the 425 pf mica capacitor known as the padder.

The above is necessarily a brief summary. It does not claim to be the whole story and many minor details have been deliberately omitted in order to avoid confusion. But it should give suffiicient background to enable the beginner to grasp the basic idea of the superhet and frequency conversion.

Having done so, he will have some idea of the purpose behind the work he is doing, as well as being better equipped in general knowledge. The finer details can be fitted into place later.

Turning to the more practical side we may now consider the components we require this month and how they are to be mounted and connected.

Two more coils will be required, aerial and oscillator, being Aegis types M24 and M26d respectively. They are similar mechanically to the IF transformers already in place, but have only one adjustable iron core. However, it is accessible from either top or bottom of the can.

As with the IF's, the coding for the lugs is given on the carton, but we repeat it here in case you should have difficulty in interpreting it. Aerial coil: Pin 1, grid; Pin 3, AVC; Pin 4, aerial; Pin 6, earth. Oscillator coil: Pin 1, osc. grid; Pin 3, padder; Pin 4, osc. plate; Pin 6, HT.

TUNING CAPACITOR

Next the tuning capacitor. This is a miniature two-gang type, having a built-in slow motion or "planetary" drive. As a result there is a worthwhile reduction in speed between the tuning knob and the capacitor. This is similar to the reduction normally provided by the tuning dial, usually by means of a cord drive, but is quite a deal simpler. We will have more to say about the dial scale itself later on.

Of the minor components the trim-

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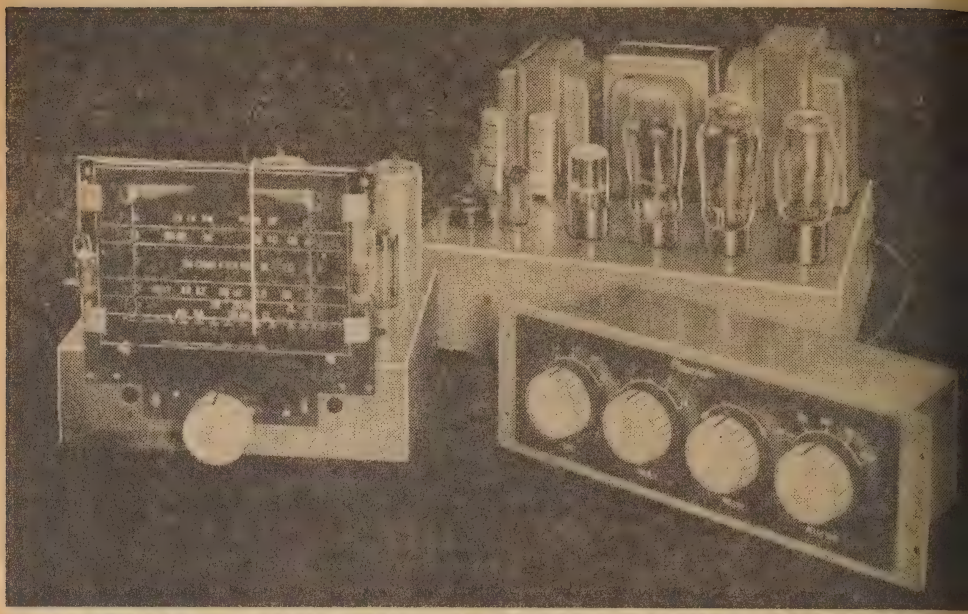

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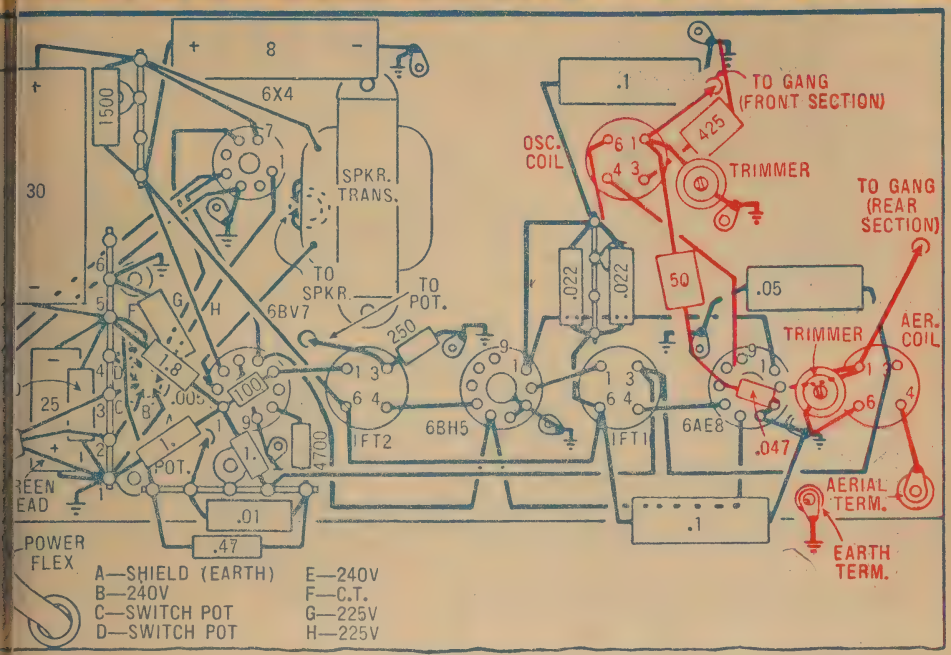

Again we present the new wiring in red to help you distinguish it from last month's. Check against last month's for details of temporary leads to be removed. Check this drawing against the underchassis photograph overleaf.

r the only ones which you are y o have encountered before and x anation of their function may

tter how carefully the coil nufacturer makes his coils, or how ly you follow our instructions, ually impossible to finish up tical values in all components ted circuits. Stray capacitance, tween wires or from wires to particularly variable.

OF ADJUSTMENT

nteract this we connect small e capacitors across each tuned ai adjust them until each circuit ctly to its required frequency. he effect of stray capacitance evident when the capacitance ning capacitor is at a minimum, ally make this adjustment at frequency end of the band.

stage the only major assembly he mounting of the gang and coils. The only comment re- ne latter is to see that they are orientated and this informa- be taken from the wiring dia-

ng the gang is a little more and calls for some detailed ex- We mounted it horizontally o achieve a reasonable cabinet nd also flush with the front chassis in order to provide shaft length. These two fac- for some minor modifications, othing which should cause any

The flush mounting means that the mounting feet must be fitted to turn under the gang and this effectively blocks off one mounting hole in each foot. We overcome this by countersinking these holes, fitting them with a suitable countersunk screw (¼in x 1/8in) and then fastening them to the gang. The whole assembly is then treated as one unit.

However, the actual fitting of the mounting feet to the gang may also call for some additional work. As received the gang should have suitable

VOLTAGE TABLE

Cathode (7) 6X4	225 volts
Screen (3) 6BV7	192 volts
Plate (2) 6BV7	210 volts
Screen (1) 6BH5	95 volts
Back bias resistor (Negative end 25 mfd electrolytic)	4 volts.

mounting holes drilled, but it is possible that these will not be tapped. In this case it will be necessary to tap the holes yourself; a simple enough job if you have the necessary taps and tap wrench.

If not you may be able to borrow a set, or you may prefer to buy them. They are not particularly expensive and a useful item in any workshop. You will need a taper and a plug tap as well as the wrench. Be very careful not to damage the gang plates in the process.

Before finally mounting the gang, solder a short length of hookup wire to the fixed plate assembly of each section. A lug for this purpose will be found at each end of the fixed plate assembly. For the rear section use the end near the edge of the chassis and the opposite end for the front section. The lead on the rear section then passes through a hole in the frame of the gang and both leads are passed through chassis holes to the underside.

At this stage it would be a good idea to mount the speaker, assuming that you have connected it only temporarily until now. You will require some 3/16in plywood for a baffle and, optionally, a piece of expanded aluminium to go in front of it. In place of the aluminium you could use a piece of cloth or special speaker grill material.

The baffle measures 8in x 5½in and the expanded aluminium approximately the same. The speaker hole should be the same shape and size as the outside of the cone, which is somewhat less than the external dimensions of the speaker. The top of the speaker should mount flush with the top of the baffle, and the bottom of the speaker should just clear the chassis.

ADDITIONAL HOLES

Additional holes will be required in both the baffle and the aluminium to take the two control shafts and also to mount the baffle. For this latter two 1/8in bolts through the lower part of the baffle and the front of the chassis will suffice. Countersunk screws

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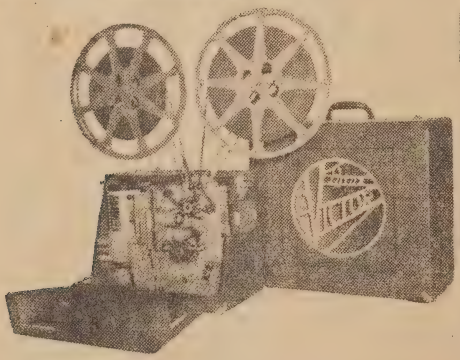

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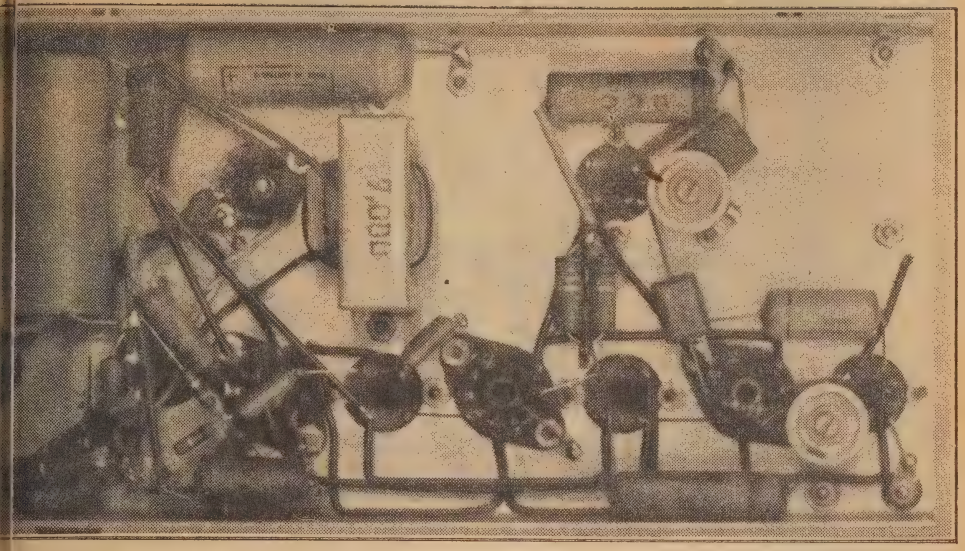
IOW IT LOOKS WHEN YOU ADD FINAL SECTION



e this picture with the diagram on page 63. The oscillator coil is towards the top and the aerial coil at the extreme ht. Note the trimmers near each coil and the padder near the oscillator coil, partly obscured by the oscillator trimmer.

g used to mount the speaker ffle.

pare for the wiring, it will necessary to remove the tem- nnections we fitted last month. the leads to pins 7 and 8 of 8 and the .047 meg. resistor. of this resistor connected to the 6AE8 and the other end porary junction of the AVC is junction will now become a nt one on pin 3 of the aerial

mainder of the wiring is fairly nd should be quite easily fol- m the circuit and wiring dia- As in last month's wiring dia- have shown all the new wiring Most of it can be done using ils of the components or tinned wire. Only one lead, apart se to the gang, uses hookup is is from pin 8 of the 6AE8 of the oscillator coil.

nting the trimmers it is desir- observe correct polarity, the ch is in contact with the adjust- w being the one to connect to sis. If the connections are the adjusting screw will be the RF sense) and correct t will be difficult. Fitting of the is best left until the other complete.

er point which may puzzle the is the mounting of the aerial h terminals. The aerial ter- eeds to be insulated from the while the earth terminal is con- o it.

rchased, each terminal should table insulating washers fitted. cases there are three washers, e and one small (the latter spacing or centring washer nside the chassis hole), while es of terminals have a cent- ring bush moulded as part of the body and require only one washer.

For the earth terminal the insulating washers should be removed and, if necessary to make a firm mechanical job, replaced with metal washers. If an aluminium chassis is used, it will be sufficient to mount directly on the chassis but in the case of a steel chassis, a connection should be made to the earthing system used to bond all earth points.

PARTS LIST

- 1 Piece aluminium for chassis 7¾ x 9 in x 16g.
- 1 Piece aluminium for V/C bracket 2⅜in x1¼ x 16 or 18g.
- 1 Power transformer 225V 50 mA 6.3V 2A Type PF201.
- 1 Oval loudspeaker type 4-5C.
- 1 Speaker transformer type EBG96.
- 1 6X4 valve.
- 1 6BV7 valve.
- 1 6BH5 valve.
- 1 6AE8 valve.
- 1 7 pin miniature wafer socket.
- 3 9 pin miniature wafer sockets.
- 2 Midget IF transformers Nos 1 and 2 types J32 and J33.

CAPACITORS

- 1 30 mfd 350 PV electrolytic.
- 1 25 mfd 40 PV electrolytic.
- 1 8 mfd 350 PV electrolytic.
- 2 .1 mfd 400V paper.
- 1 .05 mfd 200V paper.
- 1 .01 mfd 600V paper.
- 1 .005 mfd 600V paper
- 1 250 pf mica.
- 1 100 pf mica.

RESISTORS

- 1 1.8 meg ½W.
- 2 1 meg ½W.
- 1 .5 meg. pot. with single pole switch.
- 1 .47 meg. ½W
- 1 .047 meg ½W.
- 2 .022 meg 1W.
- 1 4700 ohm ½W.
- 1 1500 ohm 3W.
- 1 100 ohm ½W.

MISCELLANEOUS

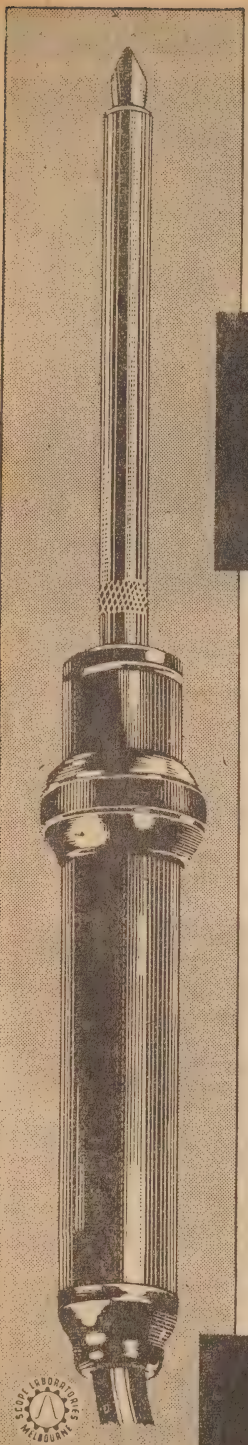
- 1 8 tag terminal strip.
- 2 5 tag terminal strips.
- 1 4 tag terminal strip.
- 3 Grommets ⅜in.
- 1 Grommet ¼in.
- 1 Knob type MV9.
- 20g tinned copper wire.
- 3 Core power flex.
- Hookup wire.
- 3 Pin plug.
- Nuts and bolts.

ADDITIONAL PARTS REQUIRED FOR THIS MONTH'S SECTION

- 1 Two gang midget tuning capacitor with planetary drive. Type R.M.G. 2V.
- 1 Aerial coil type M24.
- 1 Oscillator coil type M26d.
- 1 Large knob type MV9.
- 2 Terminals with insulating washers.

CAPACITORS

- 1 425 pf mica (padder 5 pc tolerance).
- 1 50 pf mica.
- 2 Trimmers.
- 1 Plywood baffle 8in x 5½in x 3/16in.
- 1 Piece expanded aluminium 5½in x 8in (Approx.).



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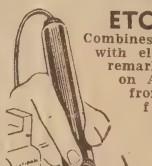

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view of the chassis with speaker in place. The aerial is on the extreme the chassis and the oscillator coil towards the front. The lead from the rear of the gang can be seen near the extreme left hand edge of the chassis.

the wiring is complete, check carefully and, if you are con- at all is as it should be, you y for the big moment — the of broadcast signals. Attach of some kind to the aerial switch on, and give the valves heat up. The set should then ns of life and tuning across l should bring in the local

LE NOT LIKELY

ing that you have checked the nce of the two previous stages nanner we suggested it is not at you will run into much t this stage. If the wiring is is only the failure of a com- which could cause bother. This ppen, though it is rare in new nts.

wever, you cannot receive sig- e set's behavior will give n of the section in which the may be found. If the set alive" and brings in static and oise when an aerial is connect- bsence of signals would be al- rtainly due to failure of the illator circuit. On the other nplete absence of noise of any ld suggest that the aerial cir- t fault.

g on the brighter side, let us — as is most likely — that an be received. The next step eally be to align the aerial and circuits until the set gives its ormance. But to do this job we require the calibrated dial place, and this cannot be done set is fitted into a cabinet. So, time being, we will have to be with a temporary alignment and ared to do the job again later. ould not be any hardship and good practice.

Commence by tuning in a station at the low frequency end of the dial (gang plates closed) say 2FC (610 Kc) or thereabouts. At this stage you may even find that the set will not tune this far, or that the station is right at the end of the band. If so our first job is to shift it to the more nearly correct position. Until we have the dial we can only guess at this, but it is possible to make a reasonable estimate.

The station is shifted by adjusting the slug in the oscillator coil, a couple of tentative adjustments serving to show in which direction the slug needs to be moved.

When this is set we proceed to adjust the aerial coil slug. This will not shift the station position, but merely bring it to maximum strength. In order to judge this position of maxium strength with the most acuracy it is best to keep the volume as low as possible.

When you feel satisfied with this adjustment tune to a station at the high frequency end, say 2SM on 1270 Kc or similar, in preparation for the trimmer adjustment. As with the slugs, the oscillator trimmer is used to set the position at which the station is received and the aerial trimmer to provide maximum sensitivity.

Once again we have no guide as to the exact setting for the oscillator circuit and, in addition, the amount of adjustment possible with the trimmer is small. For this reason it is usually sufficient to set the oscillator trimmer to a mid position and then adjust (peak) the aerial trimmer. If this latter requires to be set right in or right out in order to produce a peak, try re-setting the oscillator trimmer a few turns and try again.

Once these adjustments have been made, and assuming that the IF trans-

(Continued on page 111)

The RADIOMASTER

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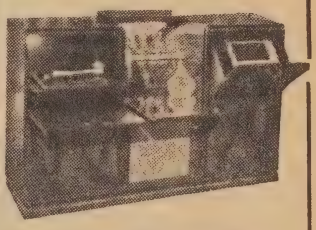

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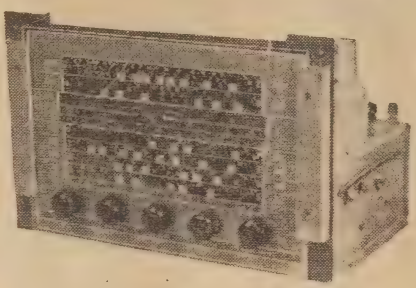

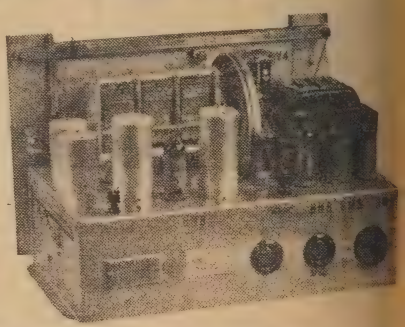

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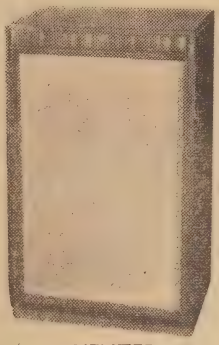

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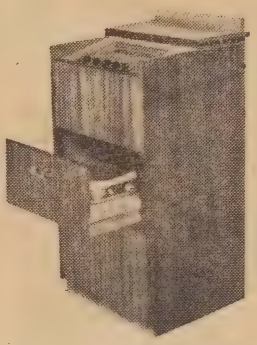

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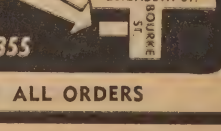

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YSTAL TYPE NOISE GENERATOR

tisfactory repair of modern high-gain electronic equipment, such as amplifiers and re-, as well as the development of this apparatus, often involves some kind of noise level ement. This article, reprinted by arrangement with the Aerovox Corporation, should therefore be of special interest to laboratory workers.

nician's attention is being increasingly to this sub- specifications and perform- rements for preamplifiers, , boosters, complete audio complete video amplifiers, unication receivers.

al presence of an electrical ground in high-gain equip- ell known. Its theoretical e been treated thoroughly and will not be discussed

nician understands that in- arises inherently from cur- and/or thermal action in tors, contacts, &c., and that e limits the smallest signal be amplified or even handled n.

lectrical noise possesses a distinguishing characteristics, pal ones are its random e distribution of its energy xtremely wide band of fre- nd its characteristic acoustic ness.

i-component waveform con- ed peaks and amplitude

dual noise level at the out- nals of an equipment may ed with an oscilloscope or C millivoltmeter. Generally, terminals of the equipment ircuited, although some speci- ay call for measurements nput open.

EADING

idual output signal can con- ddition to noise, other com- ue to hum arising within the or oscillation. Obviously, rt must be made to separate voltage from any other such ts if the noise measurement is id. This is not often easy.

nteresting to note, however, occasional specification will total residual small output l such factors under the gen- ng of noise.

dard method of noise measure- sists of feeding an adjust- itude noise signal into the in- t of an equipment under test nitoring the noise-output power quipment, and noting the in- noise-input amplitude required the output-noise power.

put noise then equals the in- ise of the equipment and, se data, a noise factor may ated.

vattmeter is not available, the ise voltage may be monitored f noise power, and increase in oltage of 1.41 times corres- ponding to doubling power. Both receivers and amplifiers are checked in this manner.

The noise test signal is derived from a noise generator, of which there are several types. Laboratory versions of this instrument are based upon a special temperature-limited noise-diode tube (example, Sylvania Type 5722).

When the plate voltage of this tube is adjusted to the level at which the filament emission is saturated (that is, all emitted electrons are collected by the plate), the shot noise generated by the diode has constant amplitude and its energy is distributed over a wide spectrum.

At intermediate plate voltages, the diode noise output is proportional to the DC plate current. Thus, by providing for smooth variation of the diode plate voltage, a noise signal of continuously variable amplitude may be obtained.

NOISE TUBES EXPENSIVE

The AC noise component generated by the tube is coupled, through the noise generator output circuit, to the input of the amplifier or receiver under test.

The diodes employed in tube-type noise generators are rather expensive. This factor plus the need for both filament and plate power supplies render the tube-type instrument unattractive to the technician and to the low-budget laboratorian.

A much simpler, yet effective, noise generator utilises the inherent noisiness of a reverse-biased point-contact silicon diode. The noise component arising from diodes of this type have been used for testing at frequencies up to 3000 megacycles and higher.

The circuit of a noise generator based upon a silicon diode is very simple, inexpensive, and reasonably rugged. It is completely suitable for the comparative measurements which suffice in common service and experimental applications.

SUITABLE TYPES

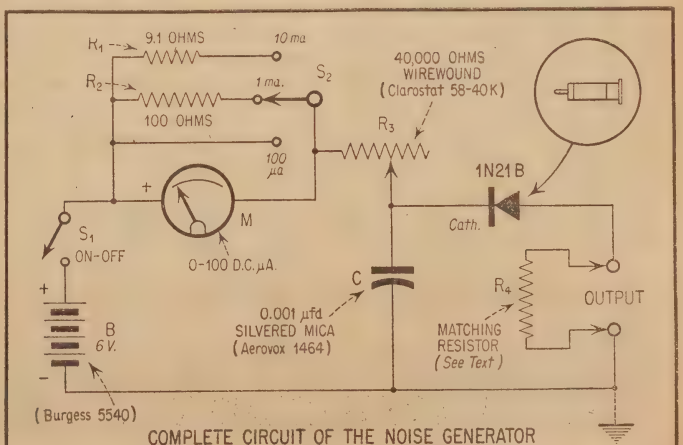
Basically, the crystal-type noise generator consists of a point-contact silicon diode, such as IN21A or IN21B. (Germanium and silicon junction types are unsatisfactory.)

The diode is reverse-connected across a battery; that is, with the diode anode negative, and a means is provided for coupling the noise energy, generated by the flow of current through the diode, out of the circuit.

Several such generators have appeared in the literature but in general have been makeshift in character and have included no means for dependable control of the noise amplitude.

The circuit of an improved generator is given in Figure 1. In this arrangement, the diode current is adjusted by means of the 40,000-ohm wirewound rheostat, R3 . The current level is indicated by the multirange meter, M. This meter has three ranges, selected by switch S2: 0-100 microamperes, 0-1 milliampere, and 0-10 milliamperes.

This arrangement for constant monitoring of the current over a possible range of 5000 to 1 enables reasonably accurate resetting of the output-noise level. The resistance values of the two-



COMPLETE CIRCUIT OF THE NOISE GENERATOR

FIG. 1

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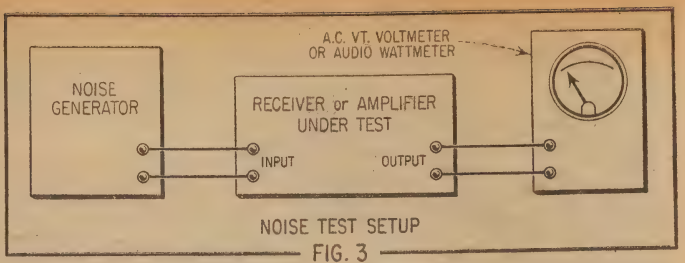
esistors, R1 and R2, are internal meter resistance

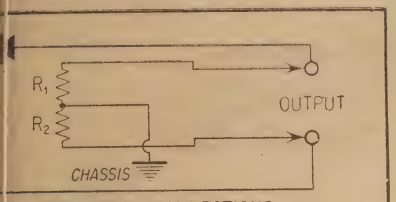
resistance of the Triplett instrument employed in ototype.

on will be necessary when internal meter resistance his 900-ohm value. In required shunt resistance uals rm/9 for the 1-ma n/99 for 10 ma. The n, is the internal meter ohms.

oise component due to



NOISE TEST SETUP
FIG. 3



ALTERNATIVE CONNECTIONS
FOR BALANCED OUTPUT
FIG. 2

uations of current in the nsmitted to the OUTPUT rough the 0.001 mfd sil- apacitor, C. For AC, this ms a closed circuit com- N21B, C, and the OUT ls.

ictive (good-grade composi- n film) resistor, R4, bridges T terminals to match the nce, or impedance, of the test.

ise generator is used, for h a receiver having an in- ce of 300 ohms, R4 will . Resistor R4 need not be ½ watt.

ny different input imped- countered in amplifiers and e question will arise as to hing arrangement has not ed here to give the noise wide range of output im-

n for not doing this was e inherent noise-generating f such a switching circuit. order to keep all internal ising in the diode, and ex- kup at a minimum, resistor N21B, and capacitor C must right at the OUTPUT ter- is insures the shortest pos-

CE MATCHING

e generator is to operate impedance, Z, a new re- qual to Z, must be fastened oss the OUTPUT terminals. e device under test has a put circuit, as often is the vision receivers, two series- resistors with their junction an be connected, for im- tching, across the noise gen- PUT terminals in the man- in Figure 2.

e of each resistor is equal re Z is the input impedance ce under test.

the generator has balanced ure 2) or unbalanced output (Figure 1), its ground must be connected solidly to the ground of the device under test.

The simplicity of the noise generator circuit removes any complication of construction. By using a 6 volt battery (B) of thin flat construction, like Burgess Type 5540 (4in x 7/8in x 2¼in), the entire instrument may be housed in a metal radio utility box slightly larger than a standard meter case.

The insert in Figure 1 shows the shape of the 1N21B diode. The metal tip on the left end of this figure is the cathode terminal which is connected to the junction of rheostat R3 and capacitor C.

The only wiring precaution is to keep all connections between the diode, capacitor, OUTPUT terminals, and R4, as short as possible. To accomplish this, solder the base of the diode directly to the upper OUTPUT terminal, and solder capacitor C from the tip of the diode to the lower OUTPUT terminal.

HEAT SINK

In order to prevent damage to the diode during this operation, hold with metal pliers the metal part of the diode being soldered. This will conduct the heat away from the diode case.

Continue to grip with the pliers until the diode is unmistakably cool to the touch.

Figue shows a typical setup for noise measurements. The following test procedure is recommended:—

(1) With the noise generator switched-off, note the reading of the output meter (AC VT voltmeter or audio watt-meter) when the amplifier or receiver is in operation and its output controls are set for normal operation.

(2) Record this deflection of the output meter, due to the inherent internal noise level of the equipment under test, as the "zero level".

(3). Switch-on the noise meter and increase its output by adjusting rheostat R3, until the output power of the amplifier or receiver (when the output meter is a wattmeter) is doubled, or until the output voltage (when the meter is a voltmeter) is increased 1.41 times.

(4). Note the reading of the current meter, M. High current values indicate a high noise level in the device under test, and vice versa.

After work is done in the device, a decrease in the initial current reading obtained in a repeated step 4 indicates an improvement in the noise characteristic; an increase in meter M deflection shows a worsening of the noise.

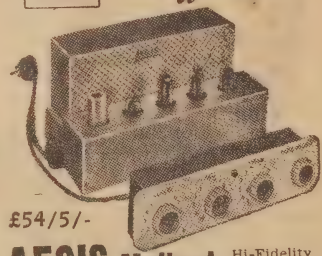
In addition to the comparative type of measurement just described, the noise generator output may be calibrated quantitatively.

One method is to plot the noise output voltage (E) at the generator output terminals vs meter M readings for a given output impedance, R4.

Either these voltages must be used in subsequent noise tests, or the noise power levels might be calculated. For either voltage or power, a separate calibration is required with each output impedance R4.

The technician will find noise measurements advantageous in checking the performance of all-wave receivers, television receivers, and amplifier systems for sound reproduction. These measurements are particularly revealing when used to determine the efficacy of TV boosters, since the latter devices are known to suffer occasionally from prohibitive noise.

For those who can hear the difference



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NEWS MAGAZINE

Figure 1: Layout of the amplifier installed in our standard CRO chassis. Small wiring components are mounted on a termin bolted to the side of the chassis. The shield at the right separates the input circuits from the leads which come down thro chassis to the panel terminals.

NEW AMPLIFIERS FOR YOUR C

This article follows the preliminary discussion in the July issue and its purpose is to detail reasons for the simplest amplifiers used in oscilloscopes not meeting the requirements television instrument. Finally, we give details of a wideband amplifier using valves avail cheaply from disposals sources and suitable for installation in existing audio type CRO's

by Maurice Findlay

OUR aim in all this is to provide readers with sufficient information either to bring an existing oscilloscope up to the standard required for television receiver servicing or to build a complete instrument cheaply, where nothing is already available.

We were originally tempted to go to a valve manufacturer's data book, pick out the most suitable valves for each particular application and design an instrument around them. However, readers wishing to duplicate the design would be faced with the purchase of up to 10 valves plus a cathode-ray tube.

In round figures, the cost through the usual channels is likely to be of the order of £20, to which must be added the cost of resistors, capacitors, transformers and many other components.

DISPOSALS PARTS

An alternative approach, and the one we have adopted in the design toward the end of this article, is to use parts available at a small fraction of the original cost from disposals dealers Compared with the £20 for the new tubes, we anticipate that if you do not already have them, you will be able to buy a set of valves including the cathode ray tube for from £4 or £5.

We must emphasise that this does not close the case for an instrument using new valves. The latest valves and cathode-ray tubes have very desirable characteristics and the performance of an instrument using them can easily be made a good deal better than with the disposals parts we have in mind.

In fact, it may well be that we will present the design for an advanced oscilloscope in these pages within the next few months. We have in mind an instrument which will be useful for laboratory and experimental work as well as receiver maintenance.

A knowledge of the principles involved is particularly important to the potential constructor of a wide-band oscilloscope and even more so when, as is the case at present, the published design may have to be modified to suit individual requirements.

Therefore, before discussing particular cases, a summary of the limitations on the performance of simple instruments, together with methods of overcoming them, will serve as a useful introduction to the subject.

The article is confined mainl vertical amplifier of the osc this being the section which m any other limits the usefulness ing instruments.

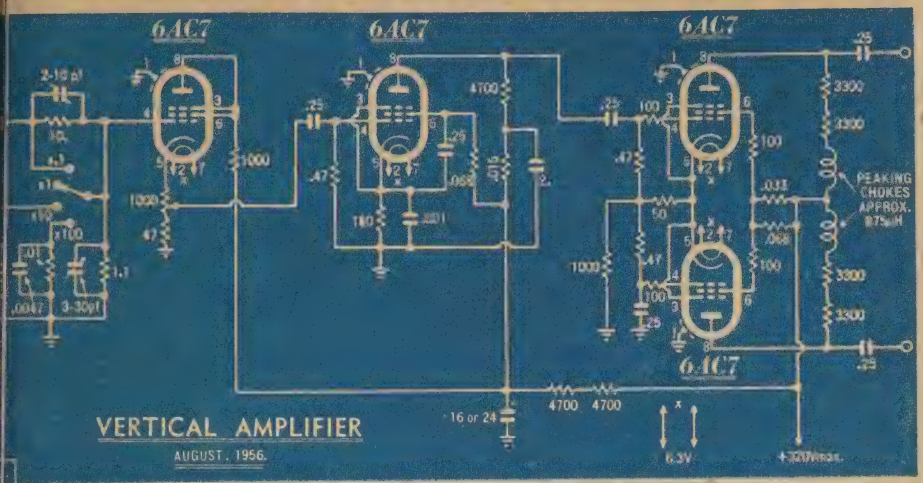
NECESSARY GAIN

Such an amplifier is neces course, because the voltages re deflect the electron beam of the ray tube are of the order of of volts, while we may often examine waveforms with an a of a fraction of a volt, when with a television receiver. Pa is this the case when the re faulty and the amplitude in th being examined is below norm

A circuit for the usual arr with a pentode voltage amplifier in Figure 3a. Allowance is t the stray shunt capacitance in circuit. This may be regard lump value which takes into ac output capacitance of the valv put capacitance of the followi and the stray capacitance betwe and connecting wires and gro

A pentode valve has a very h resistance and, for the pur simplified analysis, may be reg a constant current generator in with the plate resistance. If willing for the moment to ass both the screen and cathode capacitors act as a perfect byp

IIMUM COST WIDEBAND VERTICAL AMPLIFIER



ur new CRO vertical amplifier circuit has high input impedance, wide frequency range together with sufficient gain and output for most oscilloscopes.

the equivalent circuit of
ıay be drawn.
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plain that this circuit applies
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h the incremental plate re-
result is an accurate repre-
sentation of the behavior of the valve.

Even the circuit of Figure 3b is difficult to analyse and can be further simplified by considering separately its behavior at low frequencies, medium frequencies and high frequencies.

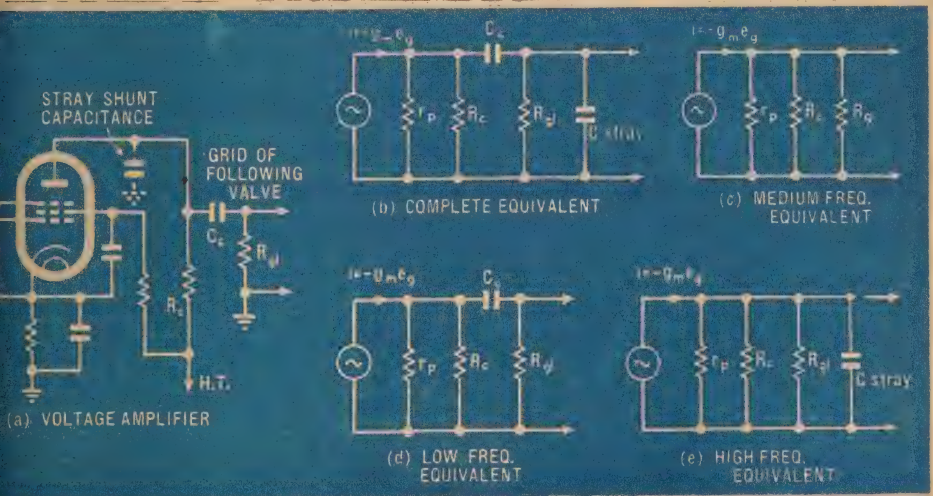
At medium frequencies, the reactance of the coupling capacitor (Cc) is low and it can be considered as a direct connection while, at the same time, the reactance of the stray capacitance is very high and can be omitted with small error. This leads to the equivalent circuit of Figure 3c.

The voltage at the grid of the following valve can be calculated by multiplying the current by the effective resistance formed by the plate resistance, the coupling resistance and the grid resistance all in parallel.

In the case of wide band amplifiers, for reasons which will become apparent in a moment, the coupling resistance (Rc) is usually small compared with the other two and the output voltage of the stage is equal to the product of the input voltage, eg, the mutual conductance of the valve (gm), and the coupling resistance.

In other words, if Rc is low compared with the other resistances, the mid-frequency gain of the stage is proportional to the coupling (or load) resistance.

At low frequencies the coupling capacitor (Cc) must be taken into account and the equivalent circuit of Figure 3d becomes applicable. The



e 3: These equivalent circuits simplify the understanding of the limitations of resistance-capacity coupled amplifiers.

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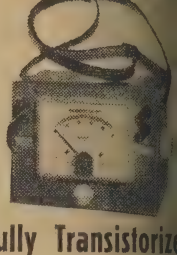

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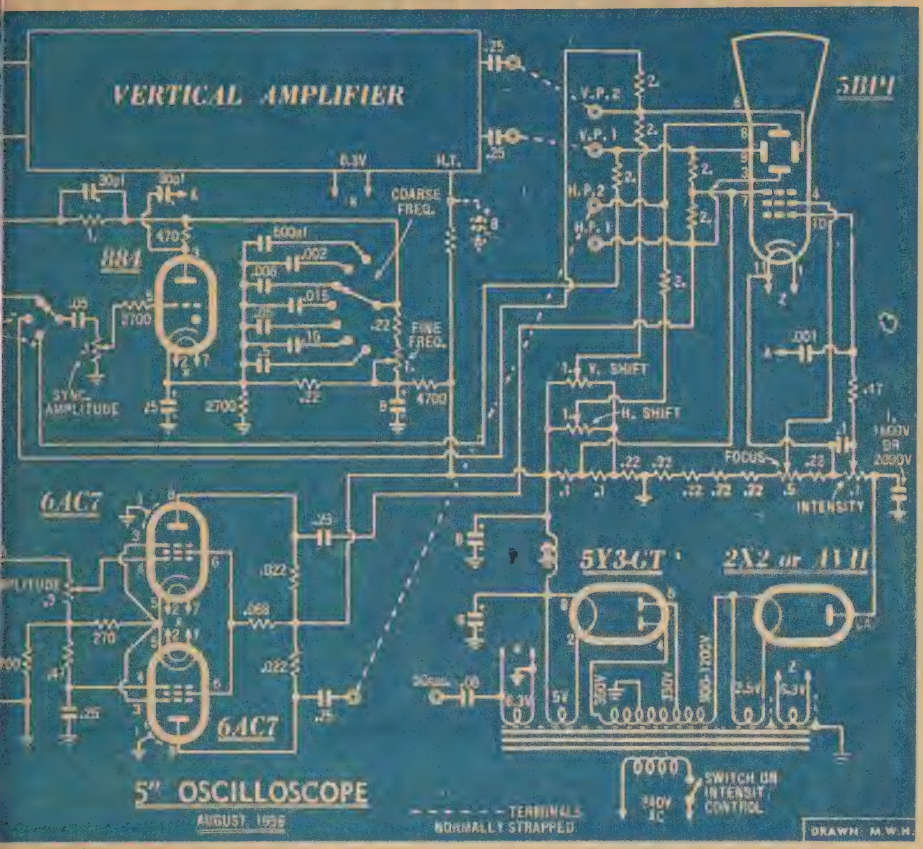

This circuit is suitable for use with the vertical amplifier circuit on page 75 and is an excellent basis on which to revise some of the earlier CRO's published in R, TV & H.

frequency, the greater the
f Cc and the smaller the
into the grid of the next
qually important for video
equirements is the change
Here the output voltage leads
signal.

e values of all components,
difficult matter to calculate
tion and phase shift at any
However, in specifying
erformance, it is usual to
requency at which the volt-
pc of that at medium fre-
This corresponds to the
alf power point.

resting to note that this point
n the reactance of Cc equals
ent resistance of rp and Rc
and then in series with Rgl.

s small compared with rp
he 70.7 pc point is reached
the frequency at which the
of the coupling capacitor
Therefore, to extend the
ncy response of an ampli-
an increase either the value
gl or both.

There are practical limits to the upper value of Rgl because of the characteristics of the following valve. In the case of certain small valves operated under special conditions, values of the order of 10 meg may be permissible but, for the valves likely to be of interest for video amplifiers, suitable values may be 0.5 meg, 0.25 meg or even lower.

LIMITING FACTOR

Large coupling capacitors are large physically and have a large stray capacitance to earth, which makes it a poor proposition to go on increasing Cc. Values up to 1.0 mfd are sometimes used, but often, when compensatory circuits are used, values such as 0.5 mfd, 0.25 mfd or 0.1 mfd could well be more suitable.

Another equivalent circuit is shown at Figure 3c and illustrates the high frequency case. Here the shunt capacitances are taken into account and a quantitative analysis of the circuit will show that the 70.7 pc point occurs at the frequency at which the reactance of the shunt capacitance equals the equivalent resistance formed by connecting rp, Rc and Rgl all in parallel.

There is also a change in phase and, in fact, the output will lag the generator at high frequencies.

To improve the high frequency response, care is taken with the circuit wiring and layout to reduce stray capacitances to a minimum. The large coupling capacitors, for example, would never be mounted directly against the chassis if this could possibly be avoided. Wiring should not be pressed against the chassis but rather run directly between the points.

This makes it necessary to take special precautions such as the installation of shielding partitions when multistage high gain amplifiers are involved.

Very obviously there is a practical limit to the minimum capacitance whic.. can be obtained and, in any case, the output capacitance of the valve plus the input capacitance of the following valve are always present.

The next step is to reduce the value of Rc. The frequency at which the

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Army phones, new, low imp., suit crystal sets, etc.	
Phones hi-impedance English Browns. Xtal sets, etc.	
4A42 Germanium Diodes. Best for crystal sets	Per dozen
Egg Insulators, porcelain	Per dozen
Dr. Cecil Crystal and detector for crystals sets	
Electric jug spirals (nichrome), 230v. 1000 watts.	Per dozen
Volume controls, midget, ¼ meg.	
Volume controls, Egan, ½ meg.	
Volume controls with switch., ½ meg.	
Valvet sockets, bakelite wafer. 4, 5, 7 pin. Mixed or one type.	Per dozen
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stray capacitance equals
parallel resistance of rp,
hen increases. In fact in
mplifiers Rc is so small
h the other two that the
rallel resistance can be
il to Rc for all practical

there is a practical limit
value which can be used.
already pointed out, the
age is proportional to Rc
too low the stage may give
in or it may even be that
oltage is less than the in-

NCE OF GM

io proportional to gm so
n gain can be made up by
ope valves. Such valves
h a fine pitch grid wound
the cathode. Manufactur-
are acute but, by reason
echniques, there are valves
res up to 10 mA/V and
ared about 1.2 mA/V for
pe valves of the 6J7-G

ive valves suitable for
lification are types
6AK5, 6AM6, 6CB6
Where higher power
o develop a high output
s a low load resistance,
as the 12BY7, 6CK6 and
have higher plate dis-
gs may be necessary.
the gm and the input and
itances affect the perform-
lve as a video amplifier, a
it taking both of these fac-
sideration is the most use-
he performance of a valve.
of merit is known as the
th factor and is expressed
for example, a valve has
width factor of 75 Mc it
in of unity for a bandwidth
a gain of 10 for a band-
5 Mc, assuming an ideal
e figure for a particular
calculated from the valve
is often available in table

is so far has neglected the
creen and cathode bypass
For the video amplifiers we
l in at the moment, these
affect mainly the low fre-
nse and the result of re-
value is similar to reducing
Cc.

VALUES

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inly those of cost and size.
mfd may be used for the
ass and possibly several
screen.
ircuits sometimes omit the
ss altogether so that there
degeneration over the en-
ternatively a useful amount
the upper end of the range
nes be obtained by using
e bypass.
odern valves are designed
are suitable for operation
een connected directly to
on line, which simplifies the
btaining a low impedance
t low frequencies.
sing the lowest practicable
e largest coupling capacitors
suitable valve, the response
ier may still not be good

CAPACITORS ABOVE CHASSIS

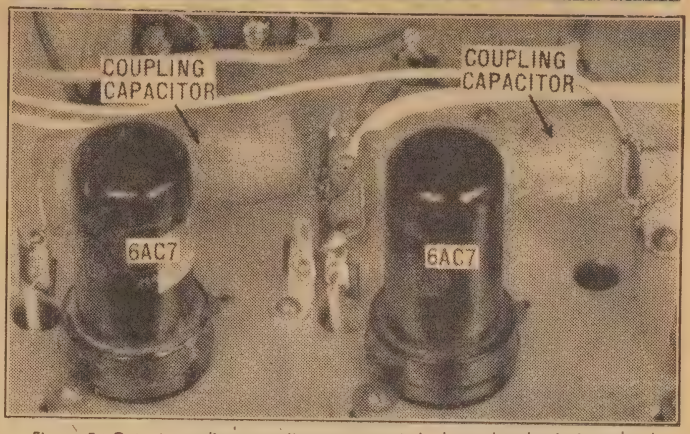

Figure 5: Output coupling capacitors are mounted above the chassis in order to keep the stray capacitances to earth low and at the same time reduce the coupling with the low level input circuits.

enough to meet the requirements.

One method of improving the performance of a video amplifier at high frequencies is to place an inductor in series with the plate load resistor so that the effective plate impedance increases with frequency. The equivalent circuit is given in Figure 6a. This arrangement is known as shunt peaking.

Here it will be noted that the coupling does in fact form a resonant circuit. The circuit is damped by Rc and values are chosen so that there are no sharp peaks in the response curve.

The best way to gain a clear appreciation of the effect of the inductor is to consider the behavior of the circuit with the inductor in relation to its behavior as an ordinary resistance-coupled amplifier. The reference frequency can conveniently be taken as the frequency at which the uncompensated amplifier gives a 70.7 pc response.

If, for the purpose of the discussion we take Q as being equal to the ratio of the inductive reactance at the reference frequency to Rc, the amplifier will behave as in Figure 6b. The logarithmic scale which is used to compress the frequency axis tends to make the graphical appearance of the improvement in performance less spectacular, but a study of the graph will show that the 70.7 pc frequency is increased by a ratio of 1.5 to 1 or better. In addition, the phase displacement is greatly reduced.

The choice of the value of Q depends on the particular circumstances. The higher values make the gain rise above the medium frequency value and if the amplifier is subjected to sharp transients the output will overshoot the correct level.

TRANSIENT RESPONSE

When a large number of stages are involved even a small amount of overshoot is multiplied and the output on transients may be a poor reproduction of the original. It may then be desirable to choose a value such as 0.4. On the other hand, if there are only one or two stages to be compensated, a value of Q equal to 0.5 will give a wider bandwidth at the expense of a slight rise in the response. In fact, for Q equal to 0.5, the rise is only 3 pc for a single stage.

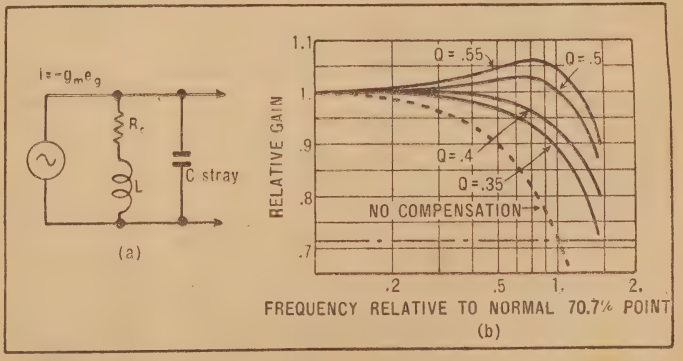

Figure 6: The effects of varying amounts of peaking inductance. For good transient performance, the response should not be allowed to rise substantially above reference level at any frequency.

Trail of wreckage left by the 1955 Maitland flood.

Aborigines were Wiser than the Whites

Aborigines were wiser than their white counterparts when it came to settlement in the Hunter River Valley district of New South Wales.

They kept to the surrounding hills — safe from the avalanche of water which they knew could bring sudden death and disaster.

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More than 10,000 subscribers' services and 400 trunk lines and telegraph channels were cut off and it was estimated that the repair bill would total more than £500,000.

Safeguard for The Future. It was a costly lesson, but today science has found a way to reduce this sort of flood damage to a minimum.

A new resin* which permanently seals telephone terminal boxes in a solid waterproof block is being used by the Postmaster General's Department on its services throughout Australia.

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he desirable features of this compensation is that it is

As you can see from the change in performance with pc change in the value of inductance is not very seri- led the amplifier does not a large number of identical ascode.

re other circuits which are used to extend the upper range of video amplifiers. ely related to the shunt peak- we have just mentioned is peaking arrangement which nnecting an inductance be- plate circuit of the amplifier he grid circuit of the fol- ge.

AL

is circuit it is possible to even higher 70.7 pc fre- in with the shunt connection t in special cases, this ad- more than offset by the fact alue of the inductor is more l also that the response falls at frequencies higher than al upper limit.

reason a simple shunt peaked eproduces the sharp peaked encountered in television test- less distortion than a series nplifier with the same 70.7 frequency. There are other ng circuits involving a num- active elements in the plate the same remarks apply to the simple series circuit.

iother method known as ompensation has many de- aracteristics and is useful for amplifiers. Design data are n the technical literature.

low frequency end of the performance of an amplifier and Rgl as large as prac- ay well be good enough to levision waveforms at frame provided the user is aware itations of his instrument and allowance.

r, a low frequency compensa- uit involving only two extra ts is available and as this ensate for attenuation due to capacitor, screen bypass and ypass capacitors at one and time, it is well worth includ-

REQUENCIES

l illustration of the arrange- iven in the circuit of the pre- 7 video amplifier circuit (Fig- vhere an additional resistance in series with the normal Rc. tance is bypassed to earth by ance, the value of which is that the effective plate load at the frequencies where the normally falls off.

king the additional resistance e and adjusting the capacitor almost exact compensation can ed. Unfortunately, very high resistance call for high supply and, as extremely good com- can be obtained with resist- y three or four times Rc, such is usually a more practical

idental advantage of the sys- additional filtering of the high upply, since the frequencies be- pensated are normally very much lower than the 100 cps fundamental of the ripple on the high tension supply line.

We made some mention last month of the need to measure the values of waveforms in television receiver testing and the limitations of the usual audio oscilloscope gain controls.

In addition to the vertical amplifier proper, readers wishing to improve an existing instrument in order to bring it into line with television test requirements will need to give consideration to this problem.

ance comparable with the vertical amplifier in the case of a service instrument.

With these thoughts in mind, we set about evolving the circuit of a vertical amplifier which would be inexpensive and at the same time easy to construct without precision measuring equipment.

We know from reports from chassis manufacturers and parts suppliers as well as direct contact with readers, that large numbers of the oscilloscopes we have described over the last few years have been constructed, particularly those

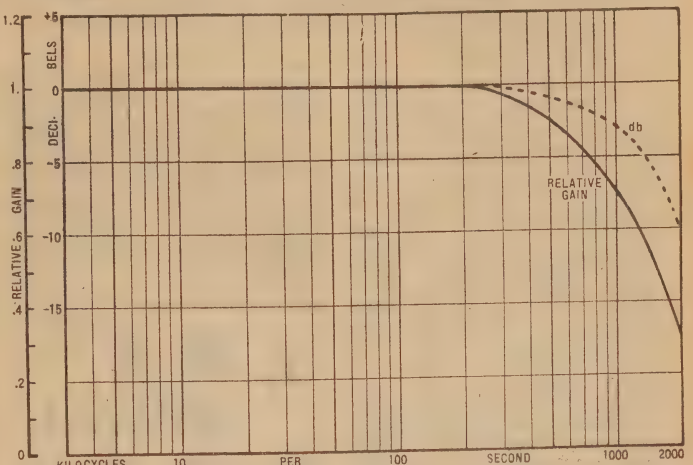


Figure 7: Response characteristic of the vertical amplifier overall in terms of relative gain. Curve in decibels is shown dotted. It was not possible to measure low frequency response directly with instruments available but calculations from square wave performance indicate that the 70.7% point occurs at less than 1 cps. Curve is independent of setting of gain control.

The linear time base using the usual gas triode included in the great majority of existing oscilloscopes is by no means ideal, but in most cases is capable of doing a satisfactory job for television testing. Any distortions caused by its use are unlikely to lead to misleading results.

A similar summing up applies to the horizontal amplifier. In few tests is it called upon to handle the video waveforms and therefore there may be little justification in designing for a perform-

AMPLIFIER DATA

Frequency Response (see article for details of conditions): 70.7% at less than 1 cps & 1 Mc.

Widest medium frequency undistorted pattern with 5BP1 A2 at 1500 volts & 320 volts supply to amplifier: 4 inches.

Minimum rms input for full output: 0.1V rms (0.28V peak to peak).

DC voltages measured with 1000 opv meter and no signal. All voltages except bias with respect to earth.

High tension supply: 320 volts, 39 mA.

Output 6AC7's. Plates: 225V. Screens: 160V. Cathodes: 32V. Bias voltage: 1.5V.

Voltage amplifier 6AC7. Supply: 195V. Plate: 95V. Screen: 85V. Cathode: 1.2V. Cathode follower 6AC7. Supply: 195V. Plate: 190V. Cathode: 4.1V.

using the 5in disposals cathode-ray tube type 5BP1. Some versions of the 5in instrument used 6AC7 valves in the amplifier circuits.

The working life of both the cathode-ray tube and the valves is likely to be very long and most readers will have these instruments with all vital parts still in very good condition.

In fact, one of our early models was still being used occasionally as a "spare" in our laboratory when the subject of TV test oscilloscopes first came up. It seemed logical therefore to use this instrument as a test bed for a new vertical amplifier and this is, in fact, what we have done.

LAYOUT PROBLEMS

The layout is by no means ideal, the panel controls and terminals not particularly well suited to wide-band amplifiers and the power transformer only able to meet a reasonable current requirement by taking some small liberties with the manufacturer's ratings. At the same time, readers would hesitate to throw away a well finished panel, and a new power transformer with ample ratings is not a cheap item.

We decided, therefore, to do the best we could with the oscilloscope in essentially the same mechanical form, bearing in mind that a response substantially level to 1 Mc is really desirable.

Deflector plates nearest the cathode are the most sensitive for the 5BP1 and

(Continued on Page 115)

A COURSE IN TELEVISIO

PART TWELVE—MULTI-CHANNEL TUNERS

For reasons which have already been outlined, it is normal practice to construct televisi tuners as completely self-contained sub-assemblies. This article discusses some of the act designs which have been used, or are being used, in television receivers.

by W. N. Williams

WITHIN the scope of such an article, it is not possible to discuss typical tuners in any great detail.

As we have already explained, the design of a satisfactory tuner involves finding a solution to many extremely difficult problems.

These include the choice of valves and of operating conditions which will ensure good electrical performance, in terms of gain, noise factor, reliability and freedom from regeneration. There are the problems of frequency coverage, frequency stability, bandwidth, ease of tuning and ease of manufacture. There is the matter of initial adjustment and accessibility for servicing, in the event of component failure.

WIRING CRITICAL

In practice, there is likely to be very little latitude in a final design. The need to tune to over 200Mc — nearly 250Mc for the oscillator — means that the amount of L and C must be reduced to extremely small proportions.

The placement of every active RF lead is likely to be significant in the final result, as also the choice of many of the small components.

When tuning units require to be serviced, therefore, they must be treated with a good deal of respect. Wires should not be pushed around haphazardly to gain access to a component or in a search for faulty joints.

Small capacitors, which may be suspect, should not be replaced by another type which merely has the same marked value. Many such capacitors have selected temperature coefficients.

The same general remarks apply to alignment, which may involve adjustments of slugs, or leads or the position of turns on a coil in some specific order.

It was one time common practice overseas to seal tuning units in an attempt to prevent anyone from tampering with them, other than a person nominated by the manufacturer.

The only safe rule, in the absence of certain knowledge, is to follow rigidly the service data, which is normally made available for such units by the manufacturer.

This present article is intended purely as a discussion of general principles and will need to be supplemented by a study of individual tuners which readers may encounter from time to time.

For the most part, the discussion centres around the methods and mechanism of tuning — or channel selection, to give it a better name.

The reason for this is obvious enough. Whereas readers have been accustomed to only one method of tuning in broadcast receivers, the special problems associated with television receivers have led to the development of many tuning methods.

Over the years, manufacturers have tended to develop and refine their own preferred system of tuning and t it for new valves and compon they became available.

Thus, over the years, old-style like the 6AC7/1852 have given to miniature pentodes of later only to be displaced, in some ca twin-triodes, cascode arrangemen such like.

Readers cannot be expected more than be aware of possible m and ideas and, as already sug study each particular tuner merits as the occasion arises.

Front-end tuners may broa divided into types which empl following predominant principles:

(1) Variable capacitance,
(2) Variable inductance and
(3) Turret tuning.

The difficulties with simple v capacitance tuning have alread explained. They stem from th that coils which are small enou resonate at over 200Mc, cann made to operate efficiently do 50Mc by simply adding parallel tance.

EXTRA INDUCTANCE

Where tuners have relied upo able capacitance, therefore, it ha usual practice to bring extra indu into circuit by one means or a so as to preserve a more uniform ratio and more uniform performa

By way of example, one early can tuner (The Sylvania) used a 5-gang variable capacitor and a for selecting the high and low b

With the switch set for the lo (54-88Mc) the gang sections wer operative and tuned moderately coils.

Switching to the high band 216Mc) shorted out portion of th or brought smaller ones into and added capacitance in serie the tuning gang, thus allowing t cuits to tune the higher frequenc

At the same time, minor c were made in the valve operatin ditions to preserve a more b overall performance.

The unit was, in fact, a ca designed 2-band VHF tuner.

Operation required the selec the low-band or high-band by a after which the receiver was tune station to station by the main v capacitor, as in an ordinary rece

The General Instrument "Ele used much the same basic desi was built into many early Am receivers.

As distinct from having the ca setting smoothly and continuousl able, some overseas capacitive have used a detent mechanism,

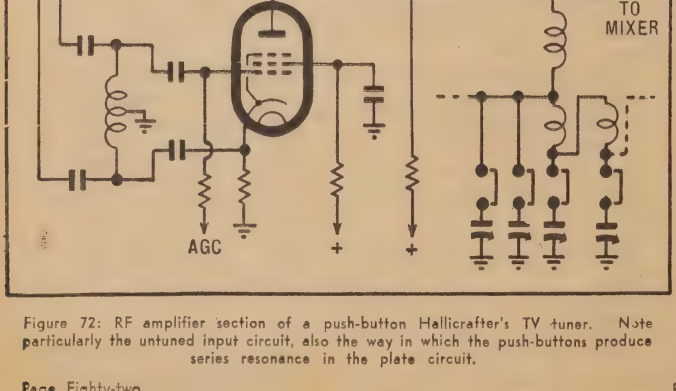


Figure 72: RF amplifier section of a push-button Hallicrafter's TV tuner. Note particularly the untuned input circuit, also the way in which the push-buttons produce series resonance in the plate circuit.

justed so that the capacitor
certain positions corres-
various TV channels.
vernier on the oscillator
d a correction for tuning

viewpoint of the user, the
ply had a "Coarse Tuning"
a "Fine Tuning" control
mbered television channels
located.
well-known American tuner
s) also used variable capaci-

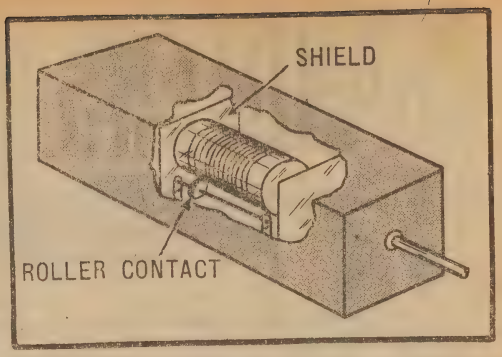


Figure 73 (right). The original inductuner had three coils on a common shaft with a roller to tap off the required inductance. Compare with figure 74, on the left.

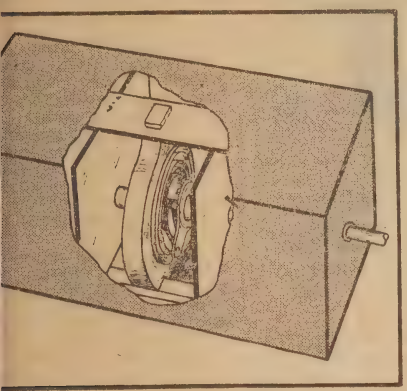


Figure 74: (left): A later version of the inductuner used fixed spiral coils and a sliding contact to tap off the required inductance. An inductance ratio of 50:1 could be achieved with this type of tuner.

considerable degree but in
with a push-button tuning
Certain details of the
worthy of comment, in pass-

) INPUT

ut circuit was untuned, the
leads connecting to the two
small choke coil, having its
earthed. (See figure 72.)
as then taken via two small
apacitors to the grid and the
cuits of a pentode RF ampli-
ode and grid return resistors
the DC circuit, the latter
oing back to the AGC control
is equivalent to the AVC
normal broadcast receiver.
ge thus operated with input
d and to cathode and assumed
ics which might be summed
ial grounded-grid operation.
vy input loading made it un-
(and perhaps impractical) to
put circuit or to achieve any
n. However, the valve itself
expected to give good gain,

though with only a mediocre noise characteristic.

Such untuned input circuits have been fairly popular in the past, overseas, though it remains to be seen whether they will be adopted for locally-made receivers. One immediate problem is whether tuners using this idea can be made sufficiently free from image and other interference problems to conform to local standards regarding oscillator radiation.

Figure 72, though much simplified, indicates the method of tuning in the plate circuit of the RF amplifier. A similar arrangement operates also in the grid circuit of the mixer and, again, to control the frequency of a two-terminal local oscillator.

One coil, connected permanently into circuit, provided the necessary inductance to tune over the higher frequency channels, being resonated by a series of pre-set trimmers, one for each channel.

On the lower bands, extra inductance as well as extra capacitance was introduced by the push-buttons, as shown.

While pre-set circuits are dependable enough for the signal frequency, they are not sufficiently free from drift for the oscillator circuit, on which the whole tuning of the receiver depends.

Thus in the Hallicrafters tuner, as in all others involving pre-set circuits, a small manual trimmer was connected across the oscillator and made available to the user as a "Fine Tuning" control.

TYPICAL TUNERS

Reference could be made to other comparable tuners but the Sylvania and Hallicrafters can be accepted as typical of those relying on variable "C", in the one case using a ganged capacitor and bandswitching, in the other case push-button control with vernier tuning on the oscillator.

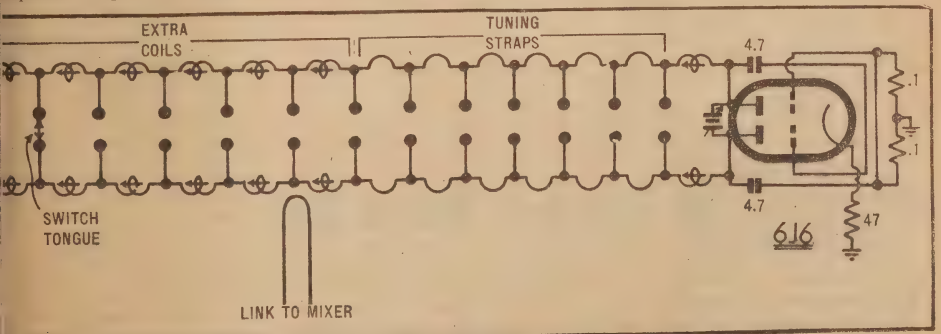
Another general class of tuner relies predominantly on varying the amount of inductance in circuit, resonating it mainly with the stray capacitance of wiring and valves

One or two of the lesser-known overseas tuners have varied the coil inductance by means of slugs in the coils, either a ferrous slug to increase the inductance or a silver-plated slug to decrease it.

However, the problem with a simple variable-slug arrangement is rather akin to the simple variable capacitor, where it is difficult to obtain a suitable range of adjustment to operate over a 4:1 frequency band.

One of the classic examples of variable inductance tuner, which avoided this limitation, was the "Inductuner" produced in the US by Mallory.

In its original form, it employed three solenoid-wound coils, in separate shielded compartments and mounted on a



5: Here is the oscillator section of an early RCA incremental tuner. The resemblance to a tuned line is obvious. A similar resonant network was used in the same unit to tune the RF plate circuit and the mixer grid circuit.

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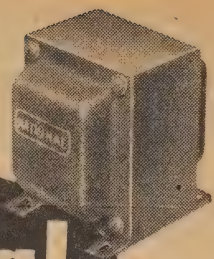

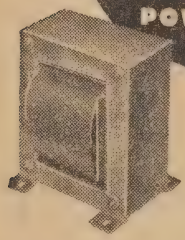

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U or F40/285	"	40	285/285	6.3v/2a 5v/2a	Upright or Flat
U or F40/325	"	40	325/325	" "	Upright or Flat
U or F50/225	"	50	225/225	6.3v/2a	Upright or Flat
U or F60/285	"	60	285/285	6.3v/2a 5v/2a	Upright or Flat
U or F60/325	"	60	325/325	" "	Upright or Flat
U or F60/385	"	60	385/385	" "	Upright or Flat
U or F80/285	"	80	285/285	6.3v/2a 6.3v/2a 5v/2a	Upright or Flat
U or F80/325	"	80	325/325	" " "	Upright or Flat
U or F80/385	"	80	385/385	" " "	Upright or Flat
U or F100/285	"	100	285/285	6.3vct/2a 6.3v/2a 5v/2a	Upright or Flat
U or F100/325	"	100	325/325	" " "	Upright or Flat
U or F100/385	"	100	385/385	6.3vct/2.5a 6.3v/2a 5v/2a	Upright or Flat
U or F125/285	"	125	285/285	6.3vct/2a 6.3v/2a 5v/2a	Upright or Flat
U or F125/325	"	125	325/325	" " "	Upright or Flat
U or F125/385	"	125	385/385	6.3vct/2a 6.3v/2.5a 5v/3a	Upright or Flat
U or F150/285	"	150	285/285	" " "	Upright or Flat
U or F150/325	"	150	325/325	" " "	Upright or Flat
U or F150/385	"	150	385/385	" " "	Upright or Flat
U175/425	"	175	425/425	6.3ct/3a 6.3/2a 5/3a	Upright
U200/385	"	200	385/385	6.3vct/3a 6.3/3a 5/3a	Upright
U250/385	"	250	385/385	6.3vct/4a 6.3/3a 5/3a	Upright
*T80/265	"	80	265/265	6.3vct/2a 5v/2a	Upright

*Low-field Tape Recorder Transformer. Details of other types available on request.

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common shaft. As the coil rotated, a small trolley wheel along the spiral winding tap more or less of the inductan figure 73.)

The method gave an inductar variation of 50:1 (from 0.02 microhenry) the unused portio coil being shorted out at all ti

THREE CIRCUITS

The coils were used in the h circuit, mixer grid and oscillator Since the latter had to opera higher frequency than the sig cuits, it was tracked by suitab and parallel fixed inductors.

In a later model tuner, th solenoid coils gave place to fixe coils, looking rather like piec clockspring. (Figure 74.)

As the tuning spindle is fingers pressing against each of coils wind around to include less of the extra inductance in By this means, continuous cov achieved from the highest to th TV channel.

This later model provides fo circuits: (1) RF amplifier grid; amplifier plate; (3) Mixer g Oscillator. Considered togeth and (3) form an RF bandpass c

For tracking purposes, each circuit includes a small varia ductor, which may be little mo a short metal strip. For trac the low frequency end, variable tive trimmers are used.

As distinct from continuously inductive tuning, many overse use a switching mechanism to inductors which resonate with capacitance to tune the various c

TWO APPROACHES

Two distinct approaches hav adopted. One is to use a separa inductor for each channel. Th provides a basic inductor for the frequency channel, then adds to it successive switch position. Th is the so-called "incremental" tu

The idea of having separate i for each channel simplifies ad to some extent because, apart f effects of proximity one to the the inductors are independent in to their adjustments.

This is not so with an incr tuner, where any change to an in inductance element may affect re on several switch positions.

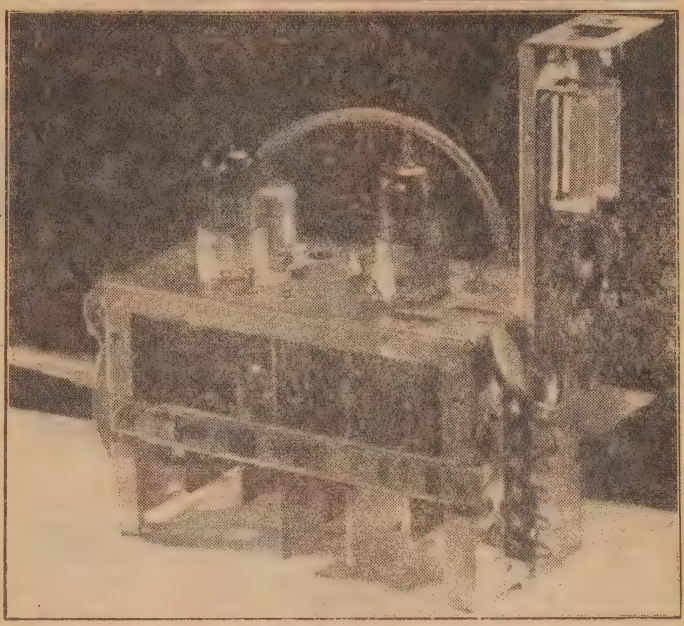
Nevertheless the incremental generally preferred because it c space and avoids the embarrass having several inactive coils shield compartment, possibly ha be shorted out to avoid spuri sonance effects.

In the American "Franklin" metal tuner, the inductor s are flat spirals which are press mating recesses in a moulded a plate. The idea is rather elabor expensive but does ensure good

More commonly, the induct ments are merely small coils o or even connecting wires betw lugs of what looks like a conv rotary wafer switch.

The wiring is arranged so t the highest frequency channel, the shortest possible path thro switch circuit. Then, as the s rotated to positions correspondi the lower frequency channels, t

A LOCAL INCREMENTAL TUNER



An Australian version of the
al tuner, manufactured by
Covers have been removed to
interior structure. At the rear
ss aerial filter. This tuner will
ed to the trade through MSP.

and the amount of induc-
ases by predetermined in-
resonate in each successive

hat the inductance progresses
periphery of a switch bank
ie particular arrangement be-
to a transmission line with
stants.
n for such a comparison be-
ent when reference is made
-pull oscillator circuit from
merican RCA incremental
re 75).
de sections of a 6J6 are

ted to form an oscillator
quency is determined by the
inductance in two parallel
to the B-plus supply point.
small inductors adjacent to
are pretuned to the highest
channel, while the capacitor
plates serves as a fine tun-

UPLING

me tuner, a comparable tun-
resonates the plate circuits
ull RF amplifier. The sig-
link-coupled to a further set
s in the grid circuits of a
so that in all there are three
three sets of inductors.
cremental tuners gave some
h switch contacts but these
been overcome.
me of writing, it would ap-
ost TV receivers sold in the
ncremental tuners on the
their relative cheapness
ers are included in this group
76 shows the tuner which is
RCA's new Personal TV
featured elsewhere in this

several big receiver manu-
re following this lead and it
hat incremental tuners will
become available to Aus-
e builders.
7 shows one such tuner —
l incremental tuner made by

ions indicate that the tuner
to operate with a 6BQ7-A
amplifier and a 6U8 triode-
quency changer.
provides four resonant cir-
F grid circuit; (2) RF plate
Mixer grid circuit and (4)

lete high-pass filter is in-
ne aerial circuit to eliminate
frequencies below about
ther unbalanced 70-ohm
le can be used or 300-ohm
ne, according to the choice
s.
ut end includes an IF trans-
couples through a low im-
axial link to the IF channel

specifications already pub-
the unit indicate excellent
e and the manufacturers
be equal to or better than
turret tuners.

Next to the incremental tuner, the type most popular overseas (and locally) is the modern Turret Tuner.

As the name implies, a turret tuner has its coils mounted around the periphery of a turret or drum, with contacts outermost. Turning the Channel Selector rotates the drum and brings the required set of coils into circuit.

Though varying in detail, most of the currently used turret tuners employ the same general constructional principles and the English "Cyldon" unit illustrated in figure 78 is typical.

The valves and their supply components along with one or two adjustments are assembled on to the main sub-chassis.

A separate panel, attaching to one side, carries the fixed contacts which bear against the coil turret, the contacts being wired in appropriate fashion to the valve circuitry.

The coil turret slips in from under-

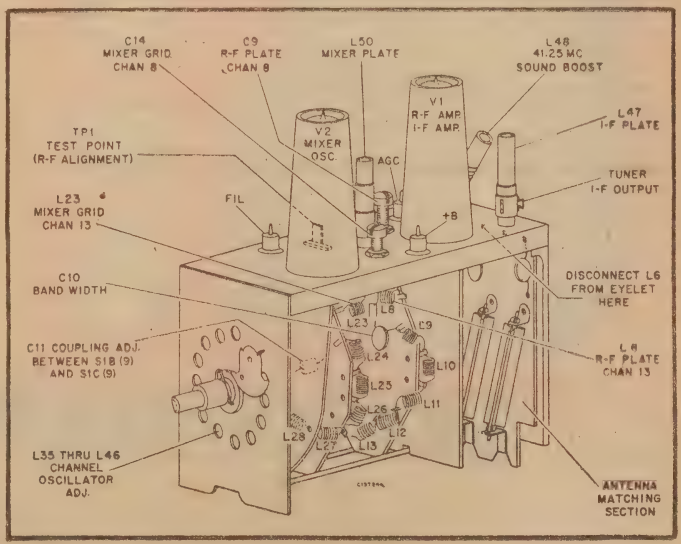


Figure 76: This sketch extracted from the service data on the new RCA Personal TV Receiver, shows their incremental tuner in miniature simplified form. For circuit details see page 89.

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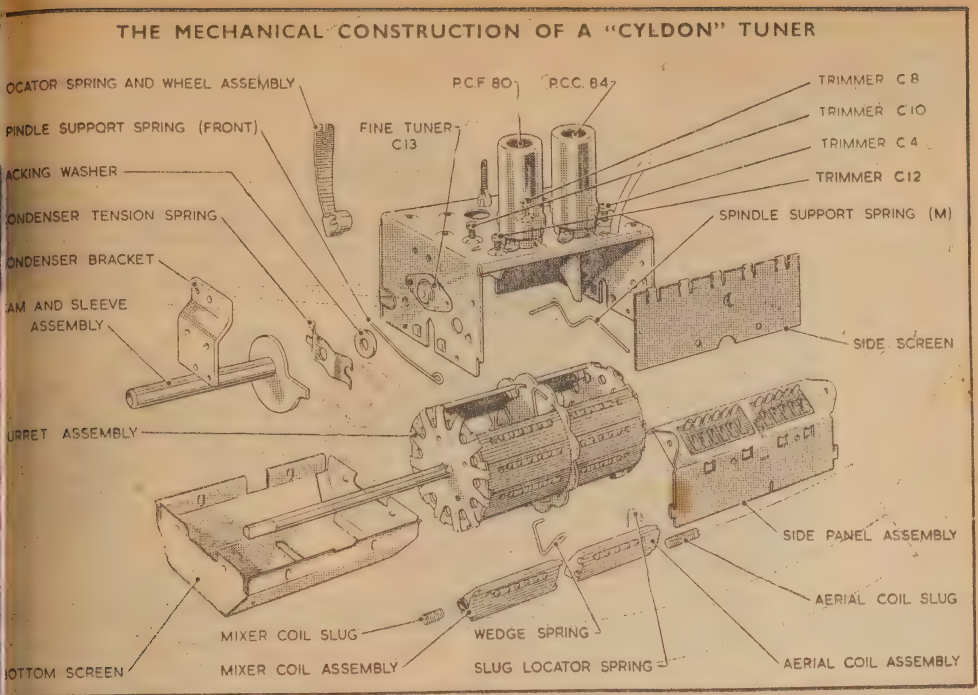


ure 78: An exploded sketch of a typical turr t tuner as mu ufactured in England by "Cyldon". A feature of such turrets is the ease with which coils can be removed or exchanged without affecting other channels.

and is provided with a locating g and wheel which allows it to positively from one position to the Each new position brings a dif- t set of coils against the contact gs.

feature of this and other turrets is act that the coils are mounted on mouldings, which carry the con- and which can be slipped in and of place very easily. It is thus ble to repair or replace coils with- dismantling the tuner or to sub- e different coil combinations to suit ent channel allocations.

MAL PRACTICE

e usual turret provides for a signal circuit, a coupling circuit between nd mixer and, of course, an oscil- circuit. Coils for the last two are mounted on opposite ends of a non former, a convenient arrange- which also provides for inductive ling between mixer and oscillator.

e coils are trimmed, either by ng the turns along the former or, me cases, by adjusting an internal slug.

ne tuning is provided by a small ble capacitor, controlled by an sleeve on the main turret shaft. entric knobs are thus required on ront panel of the receiver for chan- election and fine tuning.

most modern turret tuners, this uning capacitor has two fixed plates a vane of high dielectric material iting between them. Capacitance is num with only air spacing and mum when the intervening space en the plates is occupied by the dielectric vane.

Apart from being used immediately in commercial television receivers, tuners of this general type may well appear on the open market for sale to home constructors. They are necessarily rather expensive but capable of excellent results.

Next month, we will be discussing the intermediate frequencies which these and other tuners produce in their output circuit.

In the meantime, it is interesting to note that many tuners include the first IF transformer, their output lead being coupled to the grid circuit of the first IF amplifier.

Immediate benefit of the scheme is that it protects the tuner, particularly the mixer circuit, from possible regenerative or other disturbing effects which might result from taking a long mixer plate lead into the rest of the circuitry.

(To be continued.)

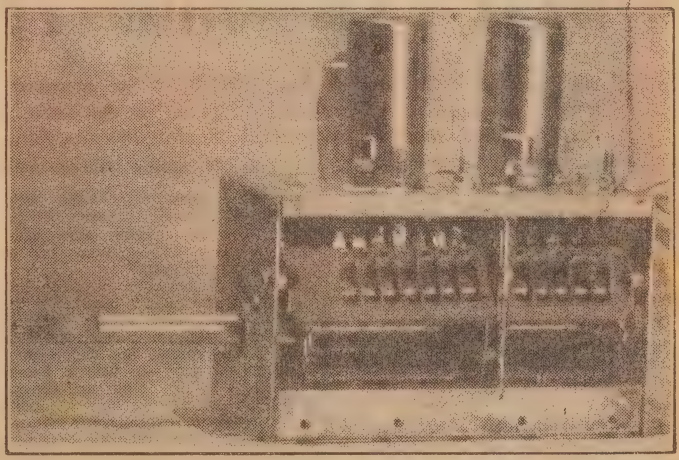
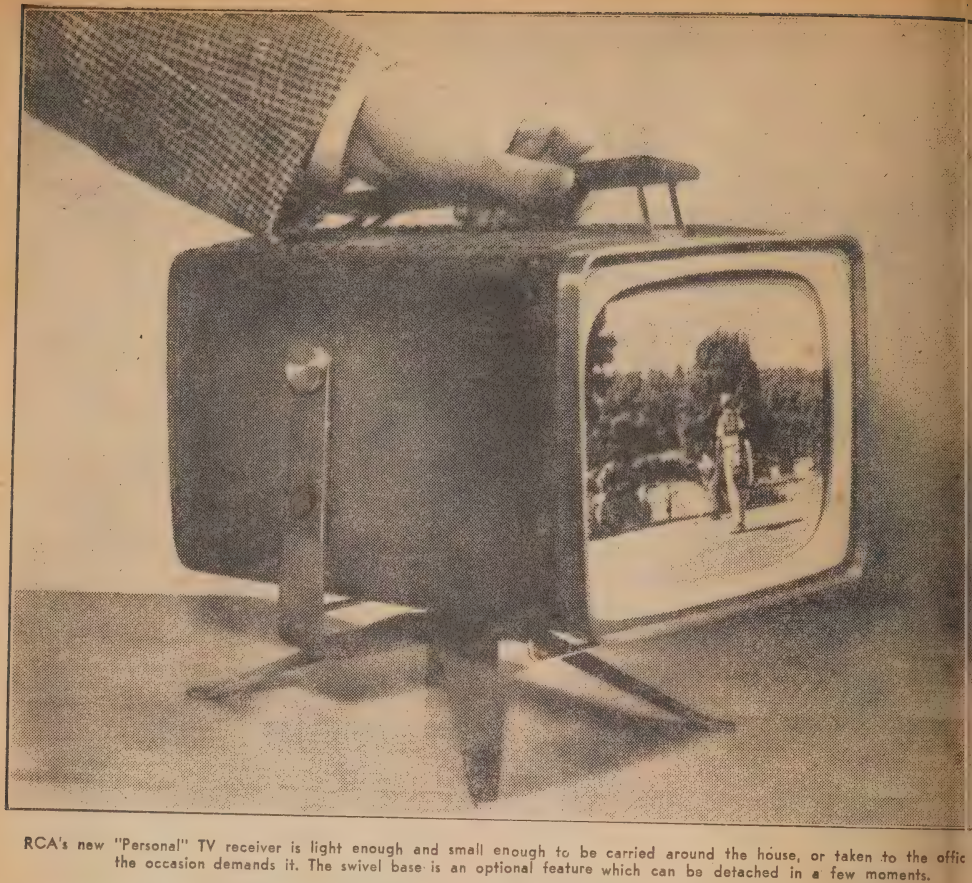


Figure 79: A turret tuner currently being used in Australia in Philips TV receivers. Circuit details were given in the May issue on page 49.



RCA's new "Personal" TV receiver is light enough and small enough to be carried around the house, or taken to the offic
the occasion demands it. The swivel base is an optional feature which can be detached in a few moments.

A NEW PERSONAL TV RECEIVE

**Big news on the American television market at the moment is the release by RCA of
"Personal" television receiver. Employing only ten valves and an eight-and-one-half inch dia
onal picture tube, the set is comparable in size with an ordinary mantel radio, viewed end-o.**

IN his recent visit to RCA, Radio, TV & Hobbies Editor John Moyle was shown one of the sets in operation. He rates it as an attractive little job, which appears to perform well, for all its simplicity. Only points of criticism were a somewhat yellowish tinge to the picture and a slight apparent picture modulation by the sound signal.

RCA is backing its new set with a tremendous sales campaign, aimed at a variety of markets. Retailing at 125 dollars, it will probably find a ready sale.

It is being pushed for use in offices by businessmen who may wish to check on commercials as they are aired during the day—or who just want to relax for a while and watch a particular programme.

Says RCA's sales letter, "What businessman hasn't wanted to keep up with the World Series—or some other televised special event—without taking time off from his desk?"

The lady of the house is being reminded that she hasn't been able to watch TV too easily in the kitchen, because most receivers to date, designed for the living rooms, are the wrong size, shape and color—as well as being too expensive at 200 dollars and above.

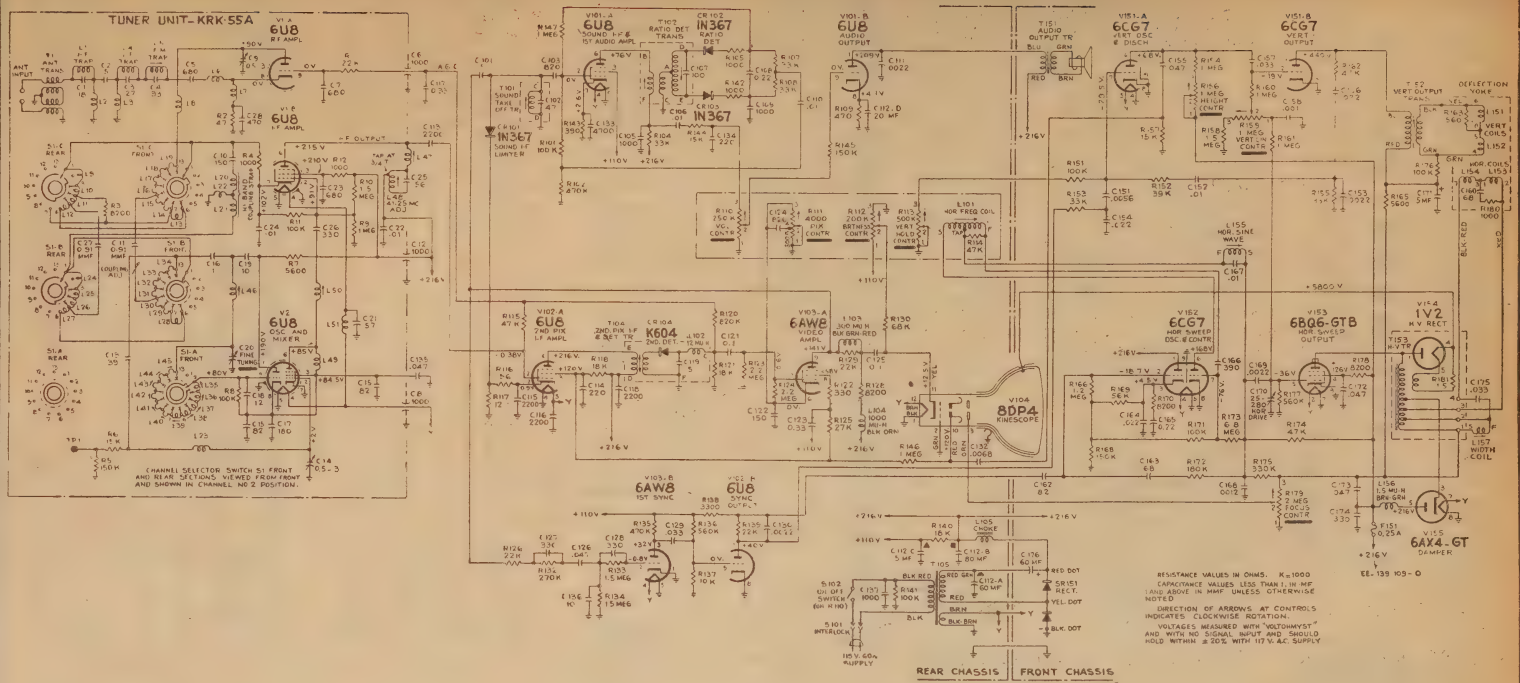
The RCA set sells for only 125 dollars, is small and rugged, has a screen large enough for personal viewing, while attending to household chores, and comes in four colors: red, grey, black and white.

Spurred by the campaign, othe
US firms are already looking at n
likely new markets—and others wi
suggest themselves.

Emerson are reported to have co
ducted preliminary tests with a mi
turised receiver in a moving car, wi
a standard "rabbit-ear" aerial. Re
are said to be encouraging, the a
difficulties occurring when the c
constantly having to change direc
or running through shielded locati

(Auto-television receivers must n
installed, by the way, in a posi
where the screen is visible to the dr

The new RCA Personal rec
weighs approximately 22lb, whic
little more than one-tenth the wg
of the same company's first table


TUNER UNIT-KRK-55A
V1-A 6U8 RF AMPL
V1-B 6U8 I.F AMPL
V2 6U8 OSC AND MIXER
V101-A 6U8 SOUND I.F & 1ST AUDIO AMPL
V101-B 6U8 AUDIO OUTPUT
V102-A 6U8 2ND PIX I.F AMPL
V103-A 6AW8 VIDEO AMPL
V103-B 6AW8 1ST SYNC
V105 6U8 SYNC OUTPUT
V151-A 6EG7 VERT OSC & DISCH
V151-B 6EG7 VERT OUTPUT
V152 6EG7 HOR SWEEP OSC & CONTR
V153 6BQ6-GTB HOR SWEEP OUTPUT
V154 1V2 H.V. RECT.
V155 6AX4-GT DAMPER
V104 21BDP4 KINESCOPE
CR101 IN367 RATIO DET
CR102 IN367 RATIO DET
CR103 IN367 SOUND I.F LIMITER
T101 SOUND TAKE OFF TRAP
T102 RATIO DET TRANS
T103 2ND PIX I.F & DET TRANS
T104 2ND PIX I.F & DET TRANS
T151 AUDIO OUTPUT TRANS
T152 VERT OUTPUT TRANS
L101 HOR FREQ COIL
L102 300 MU H
L103 300 MU H
L104 1000 MU H
L155 HOR SINE WAVE
S1 CHANNEL SELECTOR SWITCH
S102 ON-OFF SWITCH (GANG #10)
S101 INTERLOCK
SR151 RECT.
K604 2ND DET
ANT INPUT
AFC
AGC
+215 V
+216 V
+110 V
+800 V
+5800 V
REAR CHASSIS
FRONT CHASSIS
CHANNEL SELECTOR SWITCH S1 FRONT AND REAR SECTIONS VIEWED FROM FRONT AND SHOWN IN CHANNEL NO 2 POSITION
RESISTANCE VALUES IN OHMS, K=1000
CAPACITANCE VALUES LESS THAN 1 IN MF AND ABOVE IN MMF UNLESS OTHERWISE NOTED
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION.
VOLTAGES MEASURED WITH "VOLTOHMYST" AND WITH NO SIGNAL INPUT AND SHOULD HOLD WITHIN ± 20% WITH 117 V. A.C. SUPPLY
EE-139 109-0

The schematic is shown in the latest condition at the time of printing.

All resistance value in ohms. K = 1000

Direction of arrows at controls indicates clockwise rotation

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

All voltages measured with "VoltOhmyst" ® and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

CIRCUIT DETAILS :

As television circuits go, this one is very simple. Picture definition and sound output would not equal that of a more conventional set but should be adequate for the purpose. Even so, adoption of some of the techniques developed for this receiver might still show the way to simple full-scale receivers, particularly for use in high signal areas.

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SC-2 for microgroove 33⅓/45 records. Use with Acos G.P.25 and G.P.29 series turnover cartridges.

SD-1 for standard 78 r.p.m. records.
SD-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos H.G.P.33 series turnover cartridges and with Acos H.G.P. 33⅓/Garrard and Acos H.G.P. 33⅓/Collaro replacement pick-up heads.

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SK-2 for microgroove 33⅓/45 r.p.m. records. Use with Acos G.P.59 cartridges.

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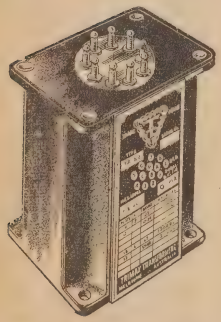

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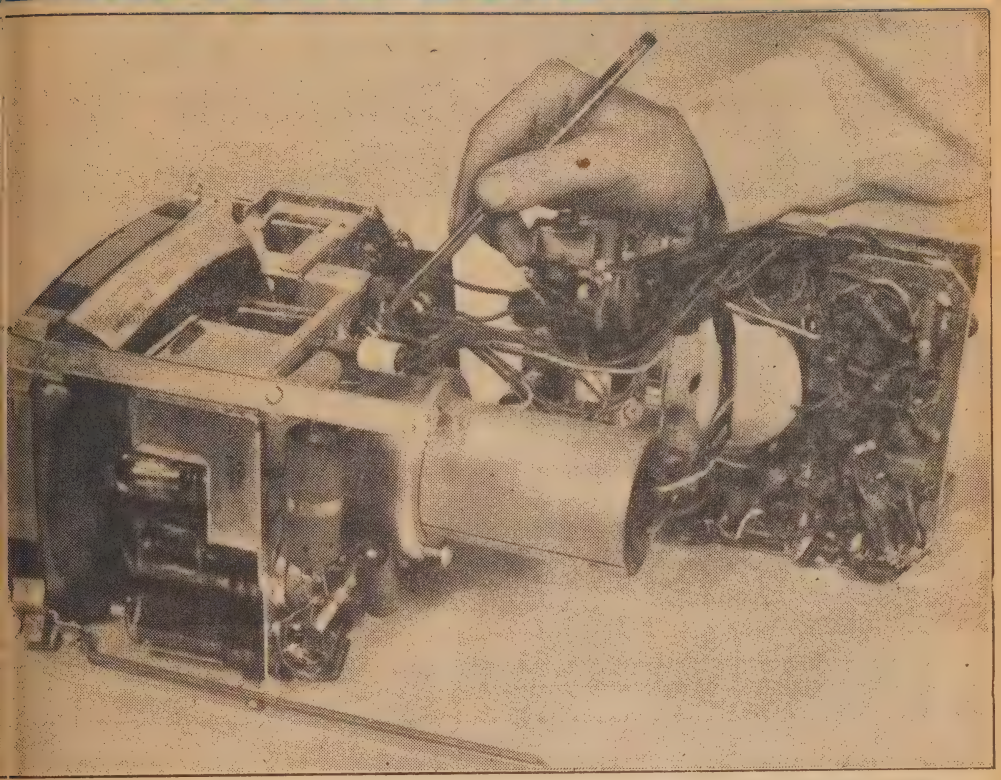
RECEIVER SHOWN DISMANTLED FOR SERVICING



n inside view of the set dismantled for servicing. Four crystal diodes perform functions which often involve valves in larger receivers.

eiver, released in 1939.
he new set measures just over 8in
h, 9½in wide and is 13in deep.
It has a carrying handle on top,
ch folds into the body of the cabi-
t. A matching stand, which attaches
cthe cabinet by a couple of knurled
obs, allows the set to be tilted at
ny required viewing angle.

NORMAL CONTROLS

Tuning controls are located under a
mall panel on top of the cabinet. They
include all those found on larger con-
ventional sets, namely fine tuning, con-
trast, brightness, vertical and horizontal
hold, channel selector and sound
volume.

For use in normal reception areas,
the set operates from an in-built "rabbit-
ear" antenna, which can be adjusted in
length to suit the channel being used.
In bad locations, the aerial is com-
pletely retracted and connection made
to a standard outdoor aerial and 300-
ohm feed line.

Heart of the new set is the recently
announced 8DP4 picture tube. This
has an 8½in outside diagonal measure-
ment and provides 36 square inches of
viewable picture — approximately 7½in
x 5½in, measured between the curved
limits of the mask.

The tube is a 90-degree deflection
type, incorporates electrostatic focus
and assumes the use of a tinted filter glass in front of the face, to allow maximum contrast to be realised.

The circuit, reproduced herewith, contains many short-cuts, which are deemed permissible in an essentially simple personal receiver.

A version of RCA's well-known incremental tuner is used, involving two type 6U8 triode-pentodes.

The triode section of one is used as a grounded-grid RF amplifier, the grid being grounded at the signal frequency but fed with an AGC control voltage.

Aerial input passes directly to the cathode circuit through a series of fixed-tuned traps and a matching transformer, which serves as a high-pass filter for frequencies above about 50 Mc.

One trap tunes the FM broadcast band, its purpose being to allow rejection of any strong interfering signal from a nearby FM transmitter.

A complete 6U8 serves as the oscillator and mixer but the signal passes from its output plate back to the pentode section of the first 6U8. This operates as a first IF amplifier, so that IF output emerges from the tuner at a relatively high level.

The tuner covers all twelve VHF television channels, between 54-88 and 174-216 Mc.

Outside the tuner, the IF signal passes to the pentode of another 6U8, which serves as the second—and final—IF amplifier. Picture IF is given as 45.75 and Sound IF as 41.25 Mc.

Ability of the receiver to operate with only two IF amplifiers is explained partly by the fact that the designed bandwidth is 2.1 Mc, which is considerably narrower than considered optimum for receivers using larger picture tubes.

A single crystal diode serves as the video detector, followed by the pentode section of a 6AW8 as video amplifier, feeding the picture tube grid.

From this same point in the circuit, output is diverted to the sync. separation circuits and also to the intercarrier sound channel.

Limiting is applied to this latter by a simple crystal diode, after which it is fed to the pentode of a 6U8 serving as the sound IF amplifier.

REFLEXED AMPLIFIER

The IF circuit is reflexed, however, so that, after demodulation by two more diodes, the audio signal is fed back into the grid circuit and amplified at audio frequency also.

Then, surprisingly enough, it passes to the triode section of the same 6U8, serving as an audio output stage. Thus, the complete intercarrier audio system for the receiver involves only one triode-pentode.

Rated audio power output in 0.5 watt.

(Continued on Page 114)

MORE ON HIGH FIDELITY

Continuing from last month an explanation of fore and aft movement would be in order.

When the stylus strikes a sharp wave front it will move forward with the front before starting to trace the wave form until sufficient pressure is built up for the stylus to then move laterally. After tracing the front the stylus then returns to its initial position, the sharper the wave front the greater the distortion and as you are aware the waveform is compressed towards the centre of the disc thus causing an increase in wave front angle and a consequent icrease in distortion.

Sydney: A. J. PHILLIPS AGENCIES PTY. LTD., Ph. BW6436

New Zealand: FRED ROTHSCHILD & SON,

79-83 PRETORIA ST., LOWER HUTT.

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Complete Audio Equipment

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PICK-UPS

Knee action stylus gives low distortion, wide frequency response; centre groove distortion is eliminated. Output .3 volt £13/10/4

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The new Mini-Mike by **Ibbott.** Frequency range 40 cycles to 7kc, output 50db. £3/13/-

TWEETER

2·5kc to 20kc; high efficiency and smooth response. Price £7/18/4.

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To suit above tweeter. .. .. Price £2/19/5.

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Results guaranteed.

£2/10/- plus freight

The only **high quality** Ribbon Tweeter . . .

KELLY RIBBON

H. F. REPRODUCER

SPECIFICATIONS:

Response .. .. 3,000-20,000 c/s	Flux .. .. 10,000 Gauss	Horn loaded .. .. .. 1,000 c/s Cut-off
Power Cap .. .. 10 watts	Dynamic Mass .. .. 0.008 gms	Dimensions .. .. 8½ x 5½ x 4½in
Impedance .. .. 15 ohms	Force mass ratio .. .. 4x10 7 dynes/gm.	Weight 8lb

We are pleased to announce that small shipments of this already famous Tweeter are now arriving.

Your local retailer will be glad to give you further details and take your order.

SOLE DISTRIBUTORS FOR AUSTRALIA

MF 821L **Simon Gray** PTY. LTD. MF 8166

RADIO DIVISION

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TRADE REVIEWS AND RELEASES

FERGUSON TRANSFORMERS FOR THE MULLARD TWENTY-WATT AMPLIFIER

Ferguson Transformers have recently announced the release of a matched set of transformers and filter choke which will interest constructors of high quality amplifiers.

THESE units have been designed to meet the specifications of the Mullard High Quality 20 watt Amplifier, and have been approved by the Technical Services Department of Mullard (Australasia Pty. Ltd.

The 20 watt High Quality Amplifier was designed by Mullard engineers in England and may be familiar to some readers through its original publication in Wireless World. It is currently featured in the Mullard publication, High Fidelity Sound Reproduction.

The output transformer in the kit, type OP312, has a primary impedance of 7000 ohms p-p, with screen taps at 43 pc.

This can be supplied with secondary windings which will match most modern loudspeakers.

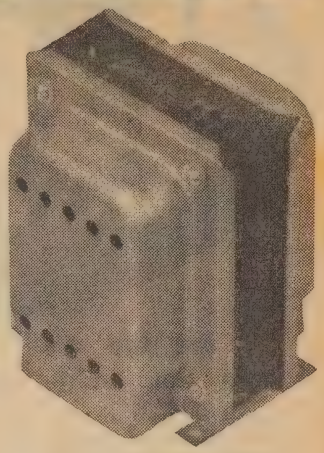
Briefly, it is being marketed with the following secondary impedance ratings — 15 ohms, 12.5 ohms and 8.4 ohms. In each case, the secondary comprises two windings and full impedance is obtained when these windings are connected in series. Connecting the windings in parallel gives a new range of values, one quarter of the previous figures: 3.75, 3.1 and 2.1 ohms.

The manufacturer's power rating of this transformer is 25 watts and, on test, the power response was between zero and —1 db from 20 to 20,000 cps at an output of 20 watts.

Details of colour coding and connections are enclosed with each transformer, together with values of the feedback phase correction capacitor required in the Mullard amplifier for various values of secondary impedance.

The power transformer, type PF1067, has the following specifications: Primary, 230-240 volts; HT secondary, 400/400 volts at 180 ma. The LT secondaries: 6.3 volts CT, at 2.5 amps, 6.3 volts CT at 4 amps, and 5 volts at 3 amps. The filter choke is a standard Ferguson type with an inductance of 12 henries, a rating of 200 mA. and a DC resistance of 100 ohms.

These units are attractively finished in grey hammer-tone and laminations are picked in black. Readers who are contemplating the construction of our 20-watt U-L Playmaster, may find this matched set a good selection for both performance and uniform appearance.



NEW DESIGN FOR MINIATURE IFT's

Messrs. R. W. Steane & Co. Pty. Ltd., manufacturers of "Q-Plus" radio components, advise that they have changed the style of their popular miniature IF transformers. As shown in the illustration, they are now made with side mounting lugs and with the core screwing directly into the threaded former. The can is slightly taller than the earlier type but there is an effective saving in height because it is no longer necessary to provide clearance for the brass adjusting screw. In the background is a new Q-Plus all-plastic alignment tool, intended for use with these IF transformers and other components using similar cores.

LONG-PLAYING "SCOTCH" TAPE

WM. J. McLELLAN & CO. PTY. LTD., Sussex St., Sydney, have advised us of the release of a new long playing magnetic tape.

Known as "Scotch" Tape No. 190AM, it has been released to meet an increasing demand. The new tape is polyster backed, enabling a reduction in thickness, and consequently allowing a greater length per roll.

The makers claim the polyster backing to be extremely strong and practically unbreakable in ordinary usage. On a 7in reel this tape is claimed to contain 100ft more than other tapes.

Retail prices are as follows: 5in reel, containing 900ft, 70/- per reel; 7in reel, containing 1800ft, 110/- per reel.

THE HI-G STORY

SOME time ago R, T & H published an article by the Editor titled What is this Hi-G Story?, explaining its meaning in the simplest terms. Cosmocord Ltd., the makers of Acos Hi-G pickups, subsequently approached us for permission to reprint this article.

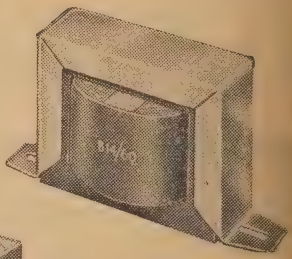
The result is a very attractive booklet, titled The ABC of Hi-G. This is freely illustrated and also contains a fairly comprehensive Acos cartridge replacement chart. Suitable replacement cartridges for most of the popular makes of record-changers and players are listed.

This booklet may be obtained free on application to Amplion (A/sia) Pty. Ltd., 88 Parramatta Rd., Camperdown, Sydney, the Australian agents for Acos products.

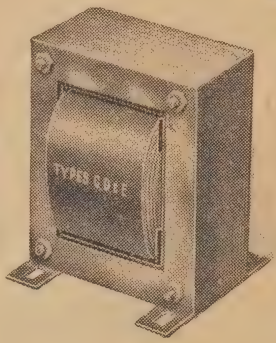
National
FILTER CHOKES

. . . are top quality chokes possessing many outstanding features!

Made by National's specialised factory, National Filter Chokes have many quality features and possess the utmost in filtering properties. Using the latest winding techniques, and incorporating the best materials, they ensure and maintain the highest possible standard in overall performances.

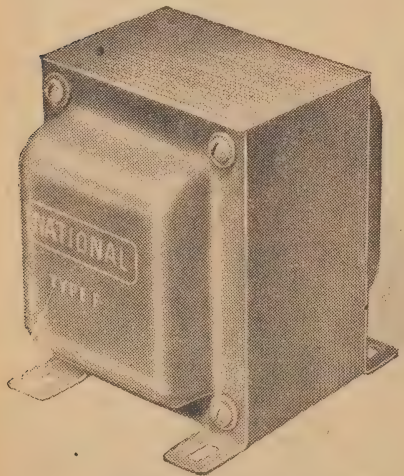


RANGE Available in all types from 50 to 250 mA. Miniature types A12/50, B14/60 available.
COIL is impregnated scientifically with special varnish and baked to resist humidity.
FOUR COOLING LOUVRES in the covers permit up draughts of cool air past winding, ensuring lower working temperatures.
UNIQUE LEAD ANCHORING inside the core prevents the leads being pulled out.



LATEST WINDING TECHNIQ

ATTRACTIVELY FINISHED in stoving enamel as National P Transformers.



When you specify National Filter Chokes . . . sp National Power Transformers . . . they are exc partners in high standard equipment.

TYPE	Inductance in Henries	mA	D.C. Resistanc
B.14/60	14	60	520
C.20/60	20	60	500
D.30/60	30	60	600
C.15/80	15	80	430
E.20/80	20	80	300
E.30/80	30	80	380
F.15/100	15	100	300
F.15/125	15	125	250
F.15/150	15	150	200
F.12/175	12	175	160
F.12/200	12	200	125
F.12/250	12	250	133

Australian & Overseas Agents:

Wm. J. McLELLAN & Co. Pty. Ltd.

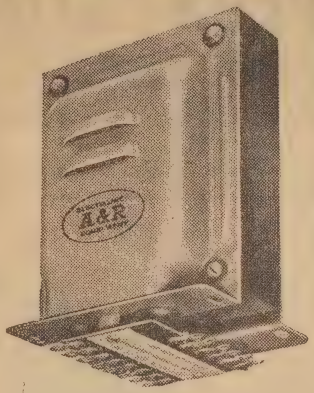
126 SUSSEX STREET, SYDNEY. BX1131

(50 yards north of King St.)

A NATIONAL PRODUCT FOR A NATION'S NEEDS

NEW A & R POWER TRANSFORMERS

& R Electronic Equipment Co. Pty. d ecently announced a new range tandard power transformers combine good workmanship with attractive price.



range includes 22 different types ith current ratings from 100 mA 0 mA and high tension secondary e ratings between 300 volts and volts. Filament windings are de- l to meet the likely requirements nsformer size.

example, type 1763 is rated at nA DC with a secondary voltage 0-0-300. One 5 volt 2 amp fila- winding and two 6.3 volt 2 amp ngs are included.

the other end of the range, type is rated at 300 mA DC, has a volt winding tapped at 850, 750, nd 500 volts each side of centre Two 6.3 volt 3 amp, two 2.5 volt p and one 5 volt 3 amp filament ngs are fitted.

e new transformers are finished with pressed steel covers of silver grey color.

A particularly pleasing feature is that windings are terminated with lugged terminal boards.

MINIATURE COSSOR OSCILLOSCOPE

Small enough to be held in one hand, this baby Cossor oscilloscope measures approximately 12 x 6 4½ inches. Weight is 9¼lbs.

E elaborate laboratory type oscil- loscopes made by Cossor are well vn. However, the model 1039M g a 2¼in diameter screen and fea- g a very compact mechanical de- may need an introduction to some. though it is not intended as a pre- n instrument, the 1039M is well d to many industrial test set-ups e a larger instrument would be bulky or too expensive. The char- istics of the internal amplifiers are enough to allow many of the dard tests on television receivers to be made when such tests are required in the home.

Four possible methods of connecting to the vertical deflector plate of the CR tube are selected by a front panel switch. They are (1) DC connection to plate (2) AC connection to plate (3) low gain AC connection through amplifier with bandwidth of 1.5 Mc (4) high gain AC connection through amplifier with bandwidth of 120 Kc.

A hard valve sawtooth oscillator with paraphrase amplifier provides a linear time base covering frequencies between 10 cps and 50 Kc. Provision is made for synchronisation. The trace is suppressed during the time base flyback.

The instrument reviewed was supplied by Jacoby, Mitchell & Co. Pty. Ltd.

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MECHANICS' STETHOSCOPES
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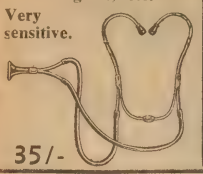

35/-

OLYMPIC GAMES
SPECIAL HIGH-POWERED BINOCULARS FOR THE CONNOISSEUR
12 x 50 . . . £26/15
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BINOCULARS BINOCULARS

£5 Allowance on Your Old Glasses
Here is your opportunity to dispose of those out of date field glasses as part payment on a modern pair of 7 x 50 or 10 x 50 high powered pair of binoculars at the amazingly low figure of **£23/15/-** for 7 x 50 or **£25/15/-** for 10 x 50. These binoculars are brand new and are of the finest quality Just mail old glasses to us with your remittance for your **£18/5/-** or **£20/15/-** for the extra high powered 10 x 50, plus 8/- extra for reg. post.

SPECIAL OFFERS

Genemotors, 12 volt input, 250 volt output 70 mills, **57/6.** Parabolic mirror, **8/6.** Magnifying Glasses, 8 mags., **8/6;** 10 magnifications, **12/6.** New Headphones suitable for crystal sets, **17/6** pair. Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, **39/6.** Vacuum Pumps, **£3/10/-.** 12 volt Spotlights, Army, **25/-;** 6 volt, **37/6.** Army Tank Aerial, 8ft, **15/-;** 12ft, **22/6.** Bases for same, **12/6.** RAAF Bomb Hoists, 33 to 1, **£10/10/-.** Tweezers. **5/6.** Watchmaker's Eyeglass, **6/6;** extra strong, 10 mag., **15/-.** Set of five Watchmaker's Screwdrivers, **13/9.** Dental Inspection Mirrors, **8/9.** RAAF 16 mil Movie Cameras 3.5 lens. **£6/6/-.** Electric Engraver, works off 6 or 12 volt battery, **29/6.** Student Microscopes. 500 mag., **£4/19/6.** 12 volt, 500 watt Generators. **£5;** 24 volt, 1000 watt Generators, **£9.**

LEARN THE MORSE CODE
IDEAL FOR BOY SCOUTS
Buzzers complete in wooden case.
12/6

COMPLETE BATTERY CHARGER

Fitted with Brand New English Selenium Rectifier.

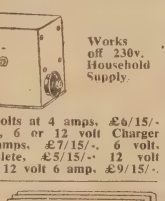
Works off 230v. Household Supply.

Charges any battery, 6 volts at 4 amps, **£6/15/-** complete. Also available, 6 or 12 volt Charger combined, Charges 4 amps. **£7/15/-.** 6 volt, 3 amp Chargers, complete, **£5/15/-** 12 volt 3 amp, **£6/15/-.** 6 and 12 volt 6 amp, **£9/15/-.**

Not secondhand.
BRAND NEW ENGLISH G.E.C. RECTIFIERS

Make Yourself a Battery Charger

12v	2 amp ..	32/6
6v	5 amp ..	50/-
12v	3 amp ..	45/-
6v	2 amp ..	24/6
6v	4 amp ..	45/-
12v	5 amp ..	79/6



Transformers to suit above, 2 amps, 39/6; 6 volt, 5 amps, 45/-; 12 volt, 5 amps, 55/-. Transformer to suit dual charger. 6 and 12 volt, 39/6. Rectifier to suit, 45/-.

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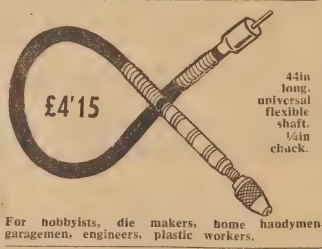
NEVER BEFORE AT THIS PRICE EVERY MOTORIST should carry one Ideal for Farmers, Naturalists, Shooters etc. In Pigskin Leather Carrying Case
20 Magnifications **£5/5/**

Also Magnification on tripod. £6/19/6.



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22/6 Complete.

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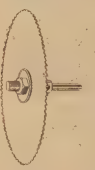

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0-3 amp meters, AC-DC, 2¼in dial 45/-
0-1 milliamp 2½in dial, 37/6
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English 0-14 amps AC-DC 4½in dial . . 59/6
Eng. 0-20 amps, 2in dial. M/c 25/-
Eng. 0-200 Ammeter, M Coil £4/10/-
Eng. 20-0-20 Ammeters, M/coil 37/6
Eng. 0-50 Amps AC-DC 3¾in dial 75/-
Eng. 0-80 Amps AC-DC, 3¾in dial 75/-
Eng. 0-1 Amps DC 2¼in dial 35/-
Eng. 200 Amps AC-DC 3¾in £4/19/6
Eng. 0-5 Amps AC-DC 2¼in 45/-
Eng. 0150 Milliamps 2¼in DC 27/6
Eng. 0-500 Microamps 3½in DC 50/-
Eng. 0-6 Amps 3¾in DC 25/-
Eng. 0-25 Volts 2¼in DC 22/6
Eng. Ohmmeter reads 0-60 M.Amps 0-500 ohms, 0-15 volts, 0-3 volts 3in dial. 45/-
0-100 milliamps, new 17/6
4 x 4½ 0/1 Milliamp Meter £5/5/-. Also 0/100 Microamp, £6/6/-.

R.A.F. LEATHER FLYING HELMETS, 50/- each.

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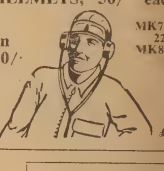

MK7 Goggles 22/6 Pair.
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WOOL LINED FLYING BOOTS £5 19/6

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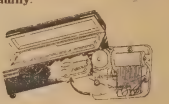
Waterproof Flying Suits. Special Price £4/7/6.

Dalton Computers in good working order. 45/-.

Replace those broken side curtai with cellulose acetate which takes t place of celluloid and lasts four tim longer. Will not discolor. SHEE 32

Now you can make your own music box w these Swiss Music Units. They can be fitted any type of box. Hours of enjoyment for family.

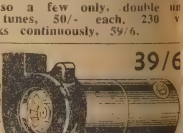


30/-
EACH

Tunes available: Lili Marlene, Blue Danu Harry Lime Theme, Wedding March, Me Widow, Happy Birthday, Anniversary Wal Silent Night, Swedish Rhapsody, Annie Laur How Dry We Are, Roll Ort The Barrel, Te Bears' Picnic. Also a few only, double un which play 2 tunes, 50/- each. 230 v Music Unit, works continuously, 39/6.

English Motor and Blower, 24 volts.

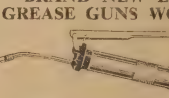
Will work off any Lighting Plant.



39/6

Large size also available that wil work off 12 or 24 volts, £3/15/-

BRAND NEW LEVER TYPE GREASE GUNS WORTH £4/19/6

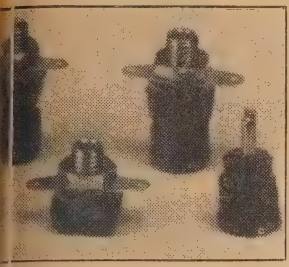


47/6

Ideal for all types of Trucks, Tractors or Cars, 7500lb pressure.

IEW CONNECTORS

Watkin Wynne Pty. Ltd., 173 Pacific Highway, North Sydney, have released a new type of banana plug and socket.



The new plugs should prove of interest to builders of test equipment,

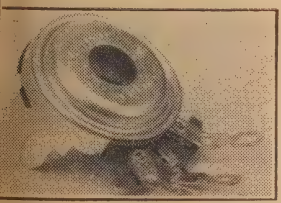
The socket fits a standard hole, and is similar in construction to the type usually encountered in multimeters with the exception of the moulded rim, which is square, and the internal diameter.

The plug, however, differs in that it is made up of three sections, a split pin, which is the plug proper, a threaded brass bush that fits over this split pin, and a moulded section which screws on the brass bush, thereby drawing the split pin down.

No soldered connection is required as the split pin has a loop in the end which is held down by the moulded portion. The connecting lead may be threaded through the loop and the action of screwing down the moulded section makes a good contact.

TAB TYPE POT.

Messrs. J. McLellan & Co. Pty. Ltd., Essex Street, Sydney, have submitted for review, an EC trimmer type control for tab mounting. This is intended primarily for use in TV receivers.



ADJUSTMENT of this unit is accomplished by means of a screw driver, which may be used either through the front or the mounting base. Standard components are used and it may be supplied in a wide selection of resistance ranges and curves.

The working voltage rating across the element is 500 volts maximum, element to ground 1000 volts RMS. and hi pot, test 1200 volts RMS. This control will find a wide application in television receivers and test equipment, where a preset semi-variable resistance is required.

ELMEC

TAPE RECORDER PARTS

FOR THE HOME CONSTRUCTOR

Call phone or write for further details of the following items

TAPE DECK KIT-SETS—TAPE DECKS—RECORD-PLAYBACK HEADS
ERASE HEADS—TAPE RECORDING AMPLIFIERS—OSCILLATOR COILS—RECORDING TAPE AND SPOOLS—MICROPHONES
CAPSTAN FLY WHEELS—CAPSTAN AND REWIND MOTORS
REPLACEMENT RUBBER TYRED MOTOR PULLEYS FOR K-1 AND K-2 DECKS

AND MANY OTHER PARTS FROM STOCK OR MADE TO ORDER

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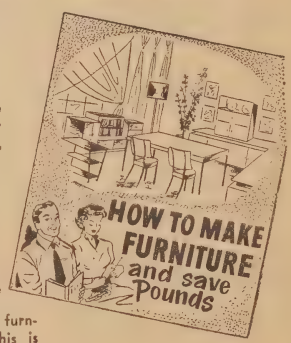

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Dept. J5, 481 Kent St.,
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Please send Free Furniture Brochure and full particulars. I enclose 3½d. stamp.

Name .....

.....

.....

MOTOR SPARES LTD

★ SPECIALS ★

1. Well-known make 6½in speakers, brand new and boxed, 10,000 ohm transformer attached, ideal for portable receivers, etc. Our price **30/- ea.**

2. **Universal Output** Transformers. Multi ratio, 5 watt rating can be connected so that any of the following ratios are available, 5000 or 7000 to 2 or 8 ohms and 600 ohm line,
or—10,000 ohm P.P. to 2 or 8 ohm
Diagram showing connections supplied with each transformer. A real bargain for **10/- each.**

3. **Bakelite Suitcase handles.** Very strong and comfortable, brown, ivory and walnut colors available. Price only **3/6 ea.**

4. Brand new stock 4 mfd 350 volt Electrolytic condensers with pigtail connections. Our price only **1/6 ea.**

5. .25 — 600 volt tubular Paper Condensers, moulded type. Price only **9d ea.**

6. Plugall receptacles as used on electric irons, etc. Ideal for connecting AC leads to portables, etc Price only **4/9 ea**

7. Plugalls with 2 yards plastic flex to match above. Price only **3/6 ea.**
8. **Short-wave coils** with adjustable iron slug. 16-50 metres. Aerial and Oscillator available. Coil diameter 9/16in. Price only **1/6 ea.**

9. **Broadcast RF Iron Cored Coils,** shielded, well-known make, high gain match H or AWA gang. Only **3/6 ea.**

10. **Broadcast Oscillator** coils unshielded iron cored, suit 6BE6 6SA7, suit H or AWA gang. Price only **3/11 ea.**

11. **Broadcast Oscillator coils,** unshielded, iron cored to suit 1R5, 6J8G, 6AN7, ECH35, etc. Price only **5/6 ea.**

12. 455KC IF transformers. English make. Price only **7/6 ea.**

13. **Dual Wave Brackets.** Well-known make, 13-42 metres and 500 to 1600 KC, new condition. Price only **30/- each.**

14. .5 mfd 200 volt Tubular paper condensers with pigtails. New. Price only **1/3 ea.**

15. RF choke with adjustable iron slug 1400 to 2200 microhenries. Price only **2/- ea.**

16. **Magneto Coils,** as used on Aircraft, suitable for spark coils, etc Ideal for the experimenter. Condenser supplied with each coil Price only **3/9 ea.**

17. **6.5 MC/S IF Transformers** made in U.S.A. Available in sets of 3. Price **19/6 per set.**

RECORD PLAYER AMPLIFIER

Just landed, another shipment of this popular line. This unit combines a 4½-watt amplifier with two inputs, one for the built-in 3-speed Philips record player and one for a crystal microphone, each input with its own volume control. Also two outputs one connected to the built-in 5-inch speaker and one for a separate extension speaker. The case is finished in two-tone leatherette. Ideal for parties, dances or for playing records in the home Worth £36/15/-.

Reduced to £19/19/-.

Extras if required—Crystal Microphone—Worth £3/19/6. **Reduced to 39/6.**
6-inch extension Speaker in leatherette-covered box. Worth £3/4/- **Reduced to 49/6.**
Also available same jobs as above, without the microphone input and external speaker connections, but with tone control. Ideal for reproduction of all types of records. **Price £19/10/-**

FOUNDATION KIT FOR TABLEGRAM, RADIOGRAM OR MANTEL RADIO SET

Consists of—Chassis, dial movement, dial glass. Chassis is drilled for standard components. Size of chassis, 15in long and 6½in wide, 7½in high. This kit is well worth £2/10/-.

Onr price is only 19/11.

SPECIAL NOTICE

All parcels sent Registered Post unless otherwise stated.
Postage or Freight must be included with order.

RECORD PLAYERS

3-speed record player in leatherett covered case, automatic stop, turnov head, 2 sapphire needles, plays sta dard and microgroove recordin, Colors fawn and brown. Worth gns.

Our price, £13/19/6.

SPRING GRAMOMOTORS, wind- type, suitable for replacement in po able gramophones, etc., complete wi turntable and fittings.

Price only, £1/15/-.

3-speed Gramo Motors, to operate 230 volt A.C. Each has speed cont knob with 33, 45 and 78 rpm positio suitable for playing standard or micr groove recordings.

Price only, £5/10/-.

3-speed Record Player Units consi ing of Motor with turnover he crystal pick-up 2 sapphire need ideal for both standard and micr groove recordings, uatomatic st English make.

Price only £9/19/6 ea.

Single Speed Gramo motors, reco ditioned and guaranteed in workin order, each motor has magnetic pic up and automatic stop. Garrad, Co laro, Paillard, etc.

Price only £2/17/6 ea.

Single speed Record Changers. R conditioned and guaranteed in wor ing order, well-known makes, Ga rard, Collaro, Plessey, H.M.V., Stror berg Carlson, etc.

Price only £4/10/- ea.

Magnetic Pick-ups. Light weight f standard recordings. Can easily adapted for microgroove recordings fitting a lead counterweight.

Price only 26/9.

AMPLIFIER CHASSIS & COVE

Amplifier Chassis and metal cov finished in silver grey hammerto with sloping front panel and plast dial plate, graduated from 0-10 for volume controls and treble and ba controls. Dial plate finished in blac and silver. This attractive Cabinet suitable for 15 to 30 watt amplifier Worth £4. Our price £2/17/6. Please send for details if intereste

547 ELIZABETH ST., MELBOURNE ALSO AT — ALBURY ARARAT BAIRNSDALE BALLARAT
BENALLA BENDIGO BROKEN HILL COLAC DANDENONG ECHUCA SALE FRANKSTON
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MOTOR SPARES LTD

CHIEFTAIN MULTIMETER

re is the new Chieftain Multimeter eviously the meter was housed in leatherette covered case. Now the e has been completely re-styled smart, durable white plastic, asuring 5¼in x 3¾in x 2-3/8in. The ter has 100 ohms internal resistance, 0 ohms per volt Voltage reading 3, 0-150, 0-300, 0-1, Ohms reading 00,000. A smart pocket size meter al for the Electrician, Radio Ser- eman, Motor Mechanic.

Price only £4/12/6.

CATHODE RAY TUBES

pe VCR138, 3½ diameter, ideal for illoscope, etc.

haracteristics:—

lament Volts 4
lament Current 1 amp
node 2 200 volts
rid 1 — 50 volts
ameter 90mm
Plate Sensitivity — 14
Plate Sensitivity 33
node 3 1200 volts
ectro-static deflection
olor Green Price 25/-.

ocket connections can be supplied to ch purchaser.

3P1 Cathode Ray Tubes. 29/6 ea.
CR97 6 inch Cathode Ray Tubes. /6 ea.
CR522 Cathode Ray Tubes, 1½ inch reen. Characteristics:—

ilament Volts 4 1.1 amps
node 2 135 volts
rid 1 — 20 volts
node 3 800 volts
ectro-static deflection.
olor Green.

ocket connections available on re- uest. Price only 25/- ea.

4 Pentode Detector, amplifier, acorn pe, 6.3 volts filament, ideal for high equency work. Price only 5/6 ea.

R130 2-volt triode for battery sets s octal socket. Price 2/6 ea.

/6G Valves. Boxed 12/6.

SR7 Metal Valves. 5/- ea.

R74, 4-volt output tetrode (same as 7), each tube supplied with socket /- ea.

V11—High voltage rectifiers. 7/6 ea.

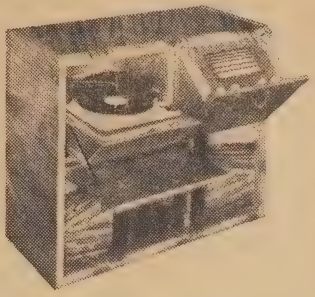
5GT—1.4 RF Pentode. 6/6 ea.

A4P—2-volt Var Mu. Pentode 5/9 ea

7 A—U.H.F. Pentode, 6.3 volt fila- ent. Octal base; an excellent tube /6 ea.

H4G 2-volt detector amplifier triode. /9 ea.

rand new and boxed. National Union 7. Valves worth 30/-. Our price 2/6 ea.



RADIOGRAM CABINETS

As illustrated latest type with slide-out changer panel and tip-out Radio set panel fitted, with velvet action door closer. Record storage cupboard. Overall size 35in long, 31in high, and 16in deep. Set panel 16 x 8. Baffle cut for 12in speaker. Changer and set panels uncut. Colors available are Walnut, Mahogany and Blond.

Price only £24/10/-.

Also Job Line secondhand Radiogram Cabinets, priced from £3/19/6 each. These are not available for Mail Orders. Please call in and inspect.

★ SPECIALS ★

10. **15 Watt Output Transformer,** 10,000 ohm CT primary to 500 and 250 ohm line and 2 ohm. Brand new stock. Worth £5. Our price 59/6.

19. **1 mfd 1000 volts Test Block Condensers. 1/6 ea.**

20. **Brand new stock.** 16 plus 16 mfd 350 volts wkg electrolytic condensers tubular with pigtails, each condenser guaranteed. **Price 5/6 each.**

21. **2 Lug Strips.** 1d ea. **9d doz.**

22. **4 Lug Strips.** 3d ea. **2/3 doz.**

23. **5 Lug Strips.** 4d each. **3/- doz.**

24. **.1 mfd 2000 volts Wkg. Block Condensers.** 2/6 ea.

25. **2 Gang Standard Condensers,** suitable for BC band. Price 12/6 ea.

26. **Miniature Shielded Aerial Coils** in square cans, new stock, a good high gain coil. Well-known make **5/6 ea.**

27. **8 mfd 100 PV Electrolytic Condensers.** Upright mounting type **1/- ea.**

28. **Noise Suppression RF Chokes,** each unit consists of a pair of honeycomb wound RF Chokes to carry AC current to radio set. By fitting this unit into a box you can make a filter. Worth 25/-. Price for unit **10/-.**

★ SPECIALS ★

29. **Oak Switches,** single bank, 1 pole 4 pos, and 1 pole 2 pos, with long shaft only. **2/6 ea.**

30. **Single Pole Midget Relays,** 50 ohms DC resistance, will operate on 6 volts. Price only **5/- ea.**

31. **50,000 ohm Carbon Pots,** with single pole switch. English make, long shaft. **5/6 ea.**

32. **Bakelite Spacers.** 3/8in diameter, 1-5/8in long with 5/32 Whitworth thread. **2d ea.** ¾in diameter, 1⅜in long with 3/16 Whitworth thread. **3d ea.**

33. **Germanium Diodes.** Ideal for crystal sets, meter rectifiers, and radio set detectors. Brand new English make. Only **5/6 ea.**

34. **Ferroxcube Rod Aerials.** Ideal for Portable, Mantle Sets, etc. Take the place of the loop aerial. Equal to 60ft outdoor aerial. Price only **16/6 ea.**

35. **Bargains in Radiogram Chassis,** complete with Dial Glass, Knobs and 12 inch Speaker. These chassis are guaranteed for 90 days, tone is good because of special bass-boost circuit. Tone control and on-off AC switches provided.
    2 types available as follows:—
    5 valves Dual Wave .. **£17/10/-**
    6 valves Dual Wave .. **£20/-/-**

36. **455 KC IF Transformers,** well-known make. New. Worth **19/6.** Our price, only **9/6 ea.**

37. **Coil Winding Wires.** Wind your own coils for crystal, valve sets, etc. Below are listed popular wires and prices per yard. We will forward you whatever length you require.

GAUGE B&S	SWG	PRICES PER YARD Enamelled	S.C.E.	S.A.S.E.
16	18	5d	6d	6d
19	20	4d	5d	5d
22	23	3d	3d	3d
24	25	2d	2d	2d
26	27	2d	2d	2d
27	29	2d	2d	2d
28	30	1d	1d	1d
29	31	1d	1d	1d
30	33	1d	1d	1d

38. Bakelite former can be supplied cut to the length you require.

Diameter	Price per inch
1 inch	5d
1¼ inch	6d
1½ inch	6d
2 inch	8d
2½ inch	9d
3 inch	10d

39. **Aluminium Chassis,** large size drilled, 16 x 9½ x 2½in. Sacrificed for **2/- ea.**

40. **3-Speed Record Changer.** Worth £22/10/-. Our price **£13/10/-.**

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OFF THE RECORD — NEWS & REVIEWS

In my last comment on the record scene, written from England, I said something about the industry's preoccupation with stereophonic sound and in the USA I found an equally keen interest, but here the vehicle most definitely is tape rather than disc. In fact I found no support at all for sterophonic discs in this country.

By JOHN MOYLE

WITHOUT doubt many of the major recording firms have experimented with discs, and they were greatly intrigued to know that a successful disc had been demonstrated at the B.S.R. Fair in London, a few weeks ago.

It is plain, also, that they too are looking for new fields to exploit in recorded music, for the microgroove disc is even more established here as the standard thing than it is in Europe. The 78 disc is so far down in popularity, as to form only a small proportion of the total number of records issued. Some labels no longer bother with them.

I don't think anyone believes that tape will make a very big hole in the disc market. It is considered to be a new field which will bring new business. This is, of course, the "hi-fi" field which is even more prolific on a percentage basis than it is in Australia, although every effort will still be made to extend its scope to the limit.

COMMERCIAL PROPOSITION

This stems from two things. Firstly a given percentage of the vast American public is so large in numbers, that it is worth the attention of even big firms; secondly the American is extremely quick to go into something new, and is extremely susceptible to advertising. America has more ways of billing a sales story, than all the rest of the world put together!

Not all the hi-fi which is peddled abroad is the real thing by any means. Americans have a genius for paring down specifications and costs to an end result, to which they will attach any label which will be accepted.

I should say that there are several stages of "fi" to be seen here, but they all have the same general idea — they give more volume, highs and lows, than the average record player.

TAPE CASSETTE

This picture will undoubtedly be extended to the tape fad, but it will, I believe, be a new kind of tape playing. The objections to the extremely awkward process of threading tape from reels, through a maze of heads and capstans, and even the added nuisance of winding back, are due to go by the board.

Instead, sooner or later will see the "tape cassette" or plastic container, which is placed upon a tape player deck with the same ease with which now dump a disc on a turntable. there is no pickup to handle—the t will automatically fall into place agai the head, and off we go.

Cassettes of this kind have been p duced for some little time, and u for continuous-play devices, although have one in my bag intended for gene use. But newer and improved devi are on the way from the big firms. T was the impression I gained from ta ing to many of them, although they a as always, extremely cagey, in ev hinting at future developments.

The stereophonic idea as applied tapes will obviously go hand in ha with such developments, and both England and in USA new versions standard tape players are being nounced.

This stereophonic trend is not to confused with true binaural sou which still pre-supposes two chann applied separately to the ears by so method such as earphones.

What is now being sold as ster phonic consists of two channels fr two separate sound tracks, but that all.

Each track is certainly not the re of a single microphone, placed in s juxtaposition with its twin as to g binaural sound.

Every stereophonic tape, at least m in USA uses a number of micropho so mixed as to give the widest poss distribution of sound when played b over two channels.

HUMAN ELEMENT

In every case, the resultant mixt finally used is that which sounded b to the man in charge of the mix panel, and of course OK'd by the c ductor and/or panel of men used the recording company to pass th tapes.

Thus it is merely an extension of mixing process now used for sin channels, particularly in the record of small groups for which individ mikes are often used on each perform supplemented, as likely as not, by m tiple tape heads and echo chambers

There is no doubt that the final sult sounds extremely good. So studios have carried the idea even furt and experimentally, at any rate, u extra channels from three, to as ma as seven. For the moment, howev we can be pretty sure that the pu will not see more than the twin-ch nel tape, and this description I f fits the case more accurately than other.

I quote a report from the Chic Sun-Times concerning a new tape pl ing system just announced by the R

Before the BBC cameras, Andre Kostelanetz conducts the Philharmonia Orchestra. At the two pianos Lisa Fuchsova and Paul Hamburg play "Carnival of the Animals" by Saint-Saens.

ded to handle tape reels as at the moment. On its accept- probably depend just how her the big companies will go ing simpler and better tape cilities.

and when these arrive, don't ed if the favored speed is 3¾in d.

1948, the year of the long-play a powerful shot in the tone corded music, 1956 may be the gives tape a new dimension.

ur months to go, and most of hi-fi shows yet to come, stereo- and is very much in the wind. some news from RCA Victor to bring it down to earth for budget group.

tape player priced at less than ls will be placed on the market his autumn. It is a complete, lug-in stereo package—two , two speaker systems and a nel tape deck.

first time," announced Harold lm, RCA Midwest regional "stereophonic sound will be r the mass market."

RISON

o players were unveiled for dis- here recently at the summer show.

year ago," Renholm said, "the ipment available to reproduce nic sound was a few profession- which sold for 1500 dollars to ars. At the present time the ice similar equipment retails twice the price of our new its."

anchoring the price to a firm reality and adapting it to the of its hi-fi line, RCA still has surprising flexibility for the system. The buyer is offered ices:

rtable system (95 dollars) con- two matching luggage-type cases ted leather. One case contains layer which will handle either ingle-track tapes, a pair of 2½- lifiers, two 3½in tweeters and a fer. In the second case is an speaker system and storage tapes.

onsolette" pair of cabinets (350 identical in appearance to RCA' Mark VI phonograph and con- he same equipment as the port- s.

eparate transport system (275 that can be hooked up with the company's three lower- honographs—the Mark IV, VI Used this way, the phonograph the right-channel reproducer for player.

REACTION

close-up preview of the units one can easily anticipate the pact which the RCA stereo will eardrums across the country monstrations begin this autumn. the pilot models demonstrated terans of a couple of conven- d ceaseless testing—sounded a ibel-weary and the tapes a little from over-splicing. But still is no escaping the promise of brilliant three-dimensional sound contained in the units.

The next big boost needed to make stereo means for mass pleasure is further reductions in the cost of the tapes.

Note that the emphasis is on mass acceptance, and not on real "hi-fi". The desire at the moment is to see how far the public will go along with the two-channel idea. If it should take on, the sky is the limit on what can follow. But as I have said, no one imagines it will seriously affect the sale of discs.

And what about "hi-fi" in its true sense?

REAL "HI-FI"

Well once again the large numbers represented by a small percentage of a big market is the answer. New York in particular has numerous shop-studios where you can hear all kinds of equipment — speakers, control units and tuners—hitched up in various ways to suit your pocket.

One such establishment has a regular dial-operated switchboard, by which the salesman can make a selection while he talks. You have never heard the hi-fi yo-yo really exploited until you listen to one of these merchants in action. If they can sell it, the stuff is good!

That is, I fear, an ever present philosophy.

In all fairness, much of it is good, and very expressive. But I have not yet seen an amplifier which is better than some of the "Playmasters" we have described.

The quality of American speakers in the top class is fine, but the majority tend to exploit the dramatic quality of bass and treble rather than to seek for a balance which doesn't give such a good demonstration to the goggle-eyed layman who has never heard much better than a mantel set.

NO REAL STANDARD

Some have never heard much recorded sound other than that which comes from a TV set, and here it is voice frequencies which are most important. The question of TV sound quality is quite a subject, and one worthy of treatment on its own.

English amplifiers and speakers have a high reputation over here. But on the whole I would say that with equipment available in Australia, we can build up a system as satisfying as any in the world.

Finally a word about record shops, particularly those in New York. Here there are literally millions of discs for sale. The big turnover in new numbers, and the fashions which follow each version, mean that vast quantities of discs are junked out at fractions of their list prices.

One comes across dozens of shops

RECORD REVIEWS

IT is regretted that absence of the Editor overseas and pressure of other technical work has made it impractical to include record reviews in this issue. We hope to recommence reviews by the Editor next month.

"The BIRTH of a PERFORMANCE"

An L.P. Recording of

ACTUAL REHEARSAL AND FINISHED PERFORMANCE

featuring

Bruno Walter

AND THE

COLUMBIA SYMPHONY ORCHESTRA

in the Symphony No. 36 in C. Major ("Linz")

Here is an album of historic importance, an L.P. album unique in its kind. It makes you, for the length of this performance, a member of a famous orchestra, sharing in the adventure of an actual rehearsal under one of the greatest conductors of our times. The work in question is Mozart at his most exquisite, and Dr. Walter (quite unconscious that a microphone in the background is acting like a Recording Angel) approaches the music with grace, freshness and mastery . . . and phrase by phrase, movement by movement, builds up this "concourse of heavenly sound". Finally, you hear the finished performance in all its lyrical perfection. But in the meantime you will have received a remarkable insight into the conductor's art, and you cannot but help surrender — wholeheartedly — to the personal warmth and charm of Bruno Walter.

Acclaimed

"THE ALBUM OF THE YEAR"

(KLC.512-513)

CBS

CORONET RECORDS

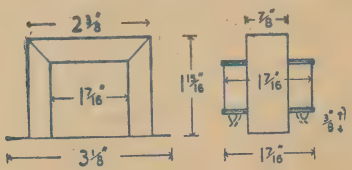
AT ALL RECORD BARS

L18

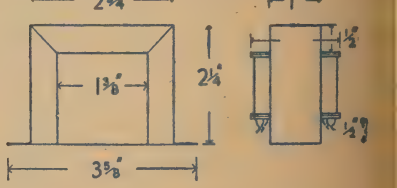
R.C.S. release details of . . . CHOKES . . . TRANSFORMERS

Here are full details of types available in R.C.S. filter chokes, audio chokes and transformers, filament and auto transformers, speaker transformers and speaker replacement windings. It is suggested that these details be kept for reference. These R.C.S. components are both designed and manufactured in the light of latest findings in the field of electronics. Brackets are of aluminium and bobbins are of moulded polystyrene.

FILTER CHOKES AND SPEAKER TRANSFORMERS
Size: Core Section ¾in x ¾in 10 watts
o/all sizes 2⅜in L x 2in H x 1⅛in W.



CHOKES AND TRANSFORMERS
Size: Core Section 7/8in x 7/8in 15 watts
o/all sizes 2¾in L x 2in H x 1⅜in W.



FILTER CHOKES

TC 66	14/60
TC 66	Windings only

SPEAKER TRANSFORMERS

Type	Primary Ohm	Voice Coil Ohm
TS 23	Single Triode	3500	2.3
TS 24	Single Triode	3500	3.9
TS 25	P/P Triode	3500	2.3
TS 26	P/P Triode	3500	3.9
TS 27	Single Pentode	5000	2.3
TS 28	Single Pentode	5000	3.9
TS 29	P/P Pentode	5000	2.3
TS 30	P/P Pentode	5000	3.9

SPEAKER REPLACEMENT WINDINGS

F 132	Single Triode	3500	2.3
F 133	Single Triode	3500	3.9
F 134	P/P Triode	3500	2.3
F 135	P/P Triode	3500	3.9
F 136	Single Pentode	5000	2.3
F 137	Single Pentode	5000	3.9
F 138	P/P Pentode	5000	2.3
F 139	P/P Pentode	5000	3.9

FILTER CHOKES
TC 60 100 M/A 30 H
TCC 70 75 M/A 50 H
TC 65 50 M/A 30 H
TC 58 L/T 3 amp 50 M/H Vib.

AUDIO TRANSFORMERS
TB 42 A Class 3 to 1
TB 43 A Class p/p 3 to 1
TB 44 B Class p/p 1½ to 1

AUDIO CHOKES
TA 4 100 H 1000 ohms

FILAMENTS AND AUTO TRANSFORMERS
TP 53 2.5 v 5 amp
TP 54 4.0 v 3 amp
TP 55 6.3 v 3 amp 15 watt
TP 80 6.3 v 4 and 2.5 auto
TP 56 12.0 v 1.5 amp
TP 57 18.0 v 1.0 amp
TP 58 240 v 0.5 amp

R.C.S. RADIO PTY. LTD., 651 FOREST RD., BEXLEY, N.S.W.

ng rows of counters, all packed
w discs, some of which are still
a few doors away, at the original
ome of these records are second
t most are as good as the day
re pressed.

proportion of these are popular
with a pronounced leaning these
12in LP's as against 10in. Music
se, for happiness, for dancing,
firelight—for all kinds of things
e hot cakes.

here is no doubt about the uni-
mpact of classical music. One
more than ever convinced that
music is the music of today,
morrow, and that even public
ers are styling their work in
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of the labels one sees do not,
se, represent complete record-
panies. Many of them do not
vn their equipment—they merely
for performances, net the re-
d sell the records. All the rest
by recording companies, which
se in this work.

some well-known names do
more than prepare their own
Someone else with a big pro-
factory actually cuts and makes
c.

is only part of the impressions
gained in looking at the record
as I have seen it. One thing is
—there is no sign of interest
g, either public or professional.
contrary—we are only begin-
dig into the enormous future
lies ahead of recorded sound.

EDITOR—OVERSEAS

From Page 31

hich prints through electrical and
tic circuits.

so saw some of RCA's new loud-
r and microphone developments
laboratory of Dr. Harvey Olsen.
ng the studio with its variable
c filter, which he used in some
classical listening tests.

e, too, I had lunch with Dr.
Woolf, the director, together with
RCA engineers, all of whom were
interested to hear anything I
to tell them about Australia.

visit to the TV color tube plant
ncaster, was another absorbing
ence. Here they have finally got
operation a production line on
tubes which moves at 20,000 per
Just how they get all those dots
right places, is a tale which can
ld later on.

lso spent an enjoyable day at the
uarters of the ARRL at West
rd, meeting in the flesh men like
Goodman,—with whom I made
ct over 20 years ago.

morrow I leave Chicago where I
headquartered for a week, for Los
les, San Francisco, and home. And
so much globe trotting, despite
umerous friends I have made and
ascinating things I have seen, the
of Sydney, which I left nearly
months ago, will look mighty good
e!

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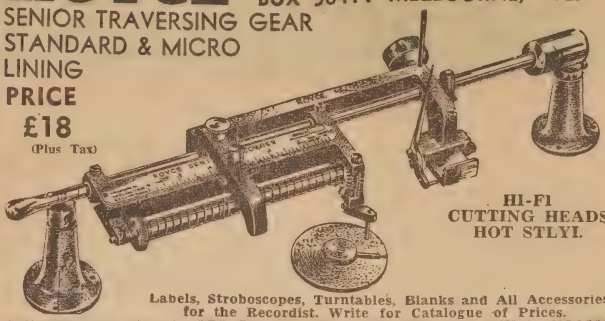

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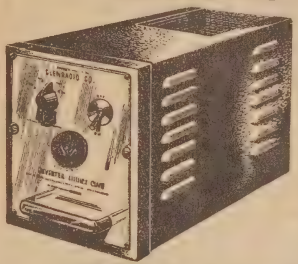

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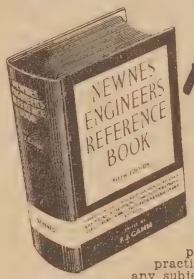

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SHORT-WAVE NOTES BY ART CUSHE

RARE STATIONS TO BE HEARD

Rare countries, including Sierra Leone and French Somaliland, have been heard this month.

THIS month we have heard two new African countries, and feature news of other rarely heard stations which are at present being heard in Europe.

During August and September, at the height of the equinox period, signals are best from Africa at dawn on both 60 and 85 metre bands. Though readers may hesitate to rise at 5 am, they will find that they are well rewarded by the most interesting stations which are to be heard.

Listeners in West and South Australia should enjoy better reception than New Zealand enthusiasts and may hear some of the stations which we are finding too weak to identify.

FRENCH SOMALILAND

The transmissions of Radio Somali operating from Djibouti have been heard on 4975 Kc. at good signal strength to sign off at 5.15 am. The programs generally consists of French musical transcribed programs issued in Paris. The sign off at 5.15 am is "Ici Radio Djibouti, las Voix la Francaise en Somali" and this is followed by the usual goodnight greetings and the French National anthem. The station operates daily 7.00-8.15 pm, 1.15-5.15 am. The latter transmission has also been heard in Europe.

SOUTH AFRICA

Not a new country, but new transmitter, presumed to be using 20 Kw., has been noted with test transmissions from Kimberley and relaying the Johannesburg programs. Frequencies of 4810 and 3340 Kc are used with English news at 3.00 and 7.00 am. An Afrikans program is heard on 3320 KC and news is presented on this channel at 3.00, 5.00, and 7.00 am.

SIERRA LEONE ON 3316 Kc.

Broadcasting from Freetown, the latest new short-wave country is operating from the African Sierra Leone. Our Swedish correspondent, Stig Dahlberg, has verified the station, his report being the first from Europe. The station operates 3.50 to 8.00 am, and uses a power of 5000 watts.

In Europe best reception is 7.30 to 8.00 am, but there is rather severe morse interference on the channel. The possibilities of hearing this station in this area are very bright, and we should be able to hear the station during August and September, when signals from the African continent are the best received on this band.

NORTHERN RHODESIA

Northern Rhodesia's broadcasting service from Lusaka is operating on 3914 and 7220 Kc. 8.00 pm (Sunday 7.00 pm)-5.00 am English (for Europeans). Fridays 4.00-5.00 am and Sunday 7.00 pm-9.00 pm and 5.00-6.00 pm. For Africans — weekdays except Fridays 4.00-5.00 am and Sundays 9.00 and 5.00-6.00 am (Monday). The second program is broadcast on 4826 Kc. daily at 1.30 to 3.30 am in native languages only. After 3.30 am the 4826 Kc channel carries the first porgram.

SEYCHELLES

A station operated by the Seychelles Broadcasting Service Education Department, Victoria Road, Mahese, operates with the low power of 35 to 40 watts. The station has been verified by a listener in Cyprus, and the schedule is given as 1.15-2.15 am, and uses the frequency of 4990 Kc. The callsign is ZCQ3 on the channel and the broadcasts are in English and French.

DAHOMEY

Broadcasts from Radio Cotonou have been heard in Europe on 4870 Kc to closing at 6.00 am but, on Mondays, a program of dramatic style is relayed from Paris with the sign off at 6.34 am. The power is 1000 watts and formerly the station operated on 4900 Kc.

Listeners' comments on reception should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are Eastern Australian

NIGERIA

The operating schedule for the Nigerian Broadcasting Service at Lagos on 4800 Kc 20 Kw is 3.00-6.00 pm, 7.30-8.00 am, Sundays to 9.00 am, Monday to 8.10 am. Kaduna, 3326 Kc 7500 W, 3.40-5.00 pm, 4.15-8.00 am, (Mon. 4.15-8.10 am). On 6175 Kc 7500 W, 11.55 pm (Sunday 11.25 pm)-4.00 am. Ibadan, 3995 Kc, 1000 W, 3.00-5.15 pm, midnight-8.00 am, (Sunday to 9.00 am). Sunday from 3.00 pm to 8.10 am on Monday. Also on 4990 Kc. 300 W. 3.00-6.00 pm, 7.30 pm-8.00 am, Saturday to 9.00 am, Sunday 3.00 pm to 8.10 am on Monday. Enugu, 3965 Kc., 2500 W., operates 3.00-6.00 pm 2.15-8.00 am; Monday 2.15-8.00 am. on 6100 Kc., 2500 W., daily 11.00 pm-2.00 am

PRAGUE USES 11975 Kc.

Prague has added a new 25 metre frequency for the North American transmission, the new channel being announced as 25.05 metres, or 11975 Kc. English transmissions are from 2.00 to 2.30 pm and 3.00 to 3.30 pm. The Sunday transmissions consists of replies to letters from listeners throughout the world, and interspersed with musical requests.

Three frequencies are used in the transmission They are, 11975, 11725 and 9550 Kc. No calls are assigned to the new frequency,. but 11725 is OI R4A and 9550 is OLR3A.

Latin American corner

THOUGH Latin American signals in the afternoons are on the wane, some interesting new stations have been logged. We find the percentage of non-verifiers is the lowest from this area and the interesting programs from these low-powered stations fascinates the listener. OAX1A, Radio Delcar, in Chiclayo, Peru, using 6150 Kc, has been heard to closing at 2.20 pm with an organ version of the "Rainbow". Another lower-powered OAX4G, Radio Lima, listed at only 25 but better than most signals on the b relay of dance music to sign off at OAX4H, Radio Mundial, in Lima, us Kc, signs off at 2.45 pm, leaving the to TGOA, Guatamala City, which has signal to sign off at 3 pm. Another malian, TGQA, Radio Nacional, on 61 been heard to after 3 pm. Its loc Quezaltenango. CE8AA, in Santiago, uses 5750 Kc, signs off at 3 pm. Chilian is CE607 on 6070 Kc; this c closes at 3 pm, and formerly used 6 Brazilians have been heard in the af PRL9 in Rio using 6147 and ZYB are the best received and usually hav sessions at 2 pm. Venezuelans have b at 5.30 pm on the 60-metre band a in the afternoons. At times, when c have been favorable, some 85-metre signa Venezuela have been coming through on this low frequency are very erratic for the two new Peruvians we mentio month, which are still being heard i Zealand.

TOKIO DROPS 17845

AFTER only a few weeks of ser 17845 Kc. Radio Japan has dele transmitter JOA21 on 17845 and repla transmissions with the other new f JOA20 on 17825 Kc. The JOA21 f was used to North America in two s sions but it seems to have given poor in the target area, as it did here. suffered from side interference from Rad tralia on the nearby frequency of 178 The new schedule for Radio Japan wh came effective on June 20 to August cludes the use of JOA20 as follows: 17825 Kc, JOB5, 15235 9-9.30 am; 17825, JOB5, 15235, 10.30-11 am; JOA20, JOB5, 15235, 1.30-2.30 pm; JOA20, 17825 15235, 4.45-5.45 pm.

New Swedish schedu

A NEW schedule of the Swedish Br ing Corporation is now in effect a covers the transmissions in English to throughout the world as follows:—

9-9.45 pm on 17800 Kc to South and Great Britain; 10-11 pm, 15155 Kc. East; 11.15 pm-12 15 am. on 15155 Eastern USA; 12.30-1.45 am on 17800 South Asia; 2-2.45 am on 15155 to US; 3-3.45 am on 17800 Kc to Middl 4-5.30 am on 15155 Kc to Africa; 6-7 6095 Kc to Europe; 7.15-8.15 am on 11 to Europe in Spanish and Portuguese; am on 11705 Kc to Europe; 9-noon on Kc to South America; 9-9.15 am on 11 to Far East; 10 am-12.30 pm on 11 to Eastern Asia; 12.45-1.30 pm on 15 to South Asia; 1.45-2.45 pm on 11705 Middle East; 3-4 pm on 11705 Kc to USA; 4.15-5 pm on 15155 Kc to Afric

The Home Service of the Swedish catsing Corporation is broadcast on waves, at 3.7 pm on 6065 Kc; 7 pm-2 11880 Kc; 2-3 am on 6065 Kc also 12,000-watt transmitter on Motala on 72 but from 4.30 to 7 am this outlet carr programs of the Second Network.

The Swedish DX Session is transmitte fourth Monday, at 10.15 pm, on 1515 12.45 am on 17800 Kc; 4.15 am on 151 6.15 am on 6095 Kc; and 11.30 am on Kcs, the day being Tuesday in this area in the first broadcast.

PROGRAMS FROM RADIO SAIGON

The position of the broadcasting services in South Vietnam, since the closing of Radio France Asia, has been obscure, but this position has now been clarified by our North American correspondent, Ken Boord. Three programs are now transmitted by Radio Saigon, the Voice of the Vietnam Republic, and each of these programs has a broadcast and short wave frequency.

CHANNEL A is broadcast on 9755 Kc, and 1000 Kc broadcast band, from 8.45 am to 3.00 am next day. English news at 2.00 am, French at 2.30 am.

CHANNEL B—is on 7290 Kc and on 836 Kc on broadcast band, operating 8.45 am-12.15 pm, 2.30-6.00 pm, 7.55 pm-2.30 am. English is broadcast at 10.15 am, 9.15 pm, 11.45 pm. English lessons at 12.45 am are for Vietnamese listeners, and at 1.30 am for French listeners.

CHANNEL C—broadcast on 9620 Kc and on 1360 Kc broadcast band, from 8.45 am-noon, 2.30-5.00 pm, 8.00 pm-2.30 am. French news at 10.00 am, 3.30 pm and 9.30 pm. US program in Vietnamese at 9.00-9.30 pm, BBC news in Vietnamese is relayed at 1.30 a.m. and VOA news at 2.00 a.m.

FLASHES FROM EVERYWHERE

BURMA'S transmissions have been move the 60-M band and have been heard b McEwan, of Melbourne, on the 9535 Kc o opening at 10 pm with drums and gong following program is in Burmese and hour is presented at 12.15 to 1.15 a program consisting of request; news is at 1.10 and signals are fair to Victo this station, though it has been in ser many years, has up to now been seld ported by listeners. The old prewar XY perhaps more consistently heard than th sent transmitter, XYZ more than ma for its popularity by its interest in tha from listeners, as far cry to the present which seems to be little interested in l reports, as our files show several atte verify their transmissions.

ANGOLA'S Emissora Oficial at Lu using the new frequency of 4950 Kc. 1SWR, and is operating 7-8.30 am. On the sign-off is 8.50 am.

HE HAM BANDS WITH BILL MOORE

REMEMBRANCE DAY CONTEST FOR AUGUST 11-12

The Wireless Institute of Australia's Remembrance Day Contest has been r noted annually since 1948 and is held in memory of radio amateurs who fell in World War II.

e conducted on the weekend nearest the ersary of VP Day, August 15, and held e tuate the memory of Australian radio ts who gave their lives for their country d t War II.

e names and callsigns are engraved on e hy which is awarded annually to the e of the WIA whose leading competitors e the highest score.

e purpose of the contest, amateurs he Australian Capital Territory, VK1 ye regarded as operating in the VK2 n with regard to rules, scoring, return

irs in the VK1, Antarctica Call Areas, rticipate in the contest. Scoring for with VK1 (Antarctica) are six points act per band for all States.

les for the contest are as follows:—
contest will commence at 1800 hours, n August 11, and continue through until irs, on August 12.

contest is open to all Australian amat only members of the WIA are eligible awards.

ing the contest, C.W., phone or a com- of both may be used.

contest is an interstate contest and in each State will endeavor to contact in all other States.

station may be operated by more than ator under the station callsign provided erators, other than the station licensee, n separate log under his own callsign ost purposes.

R OPERATORS

plement this rule, the following pro- hall be adopted by all licensees other owner of the station concerned.

ensees operating stations other than n shall, for the purpose of these rules, nafter referred to as "substitute opera-

one Contacts: Substitute operators will ") Remembrance Day", followed by the of the station they are operating and "log" followed by their own callsign. (b) Contacts: Substitute operators will call ") de", followed by a group callsign com- the callsign of the station they are t, an oblique stroke, and their own

ceiving Contestants: Contestants receiv- nals from substitute operators will for points by recording the callsign substitute operator only.

(c) Nothing in (a), (b) or (c) above will preclude the station licensee from participating in the contest himself providing he submits a separate log under his own callsign.

6. All existing amateur bands may be used and all transmissions must conform with regulations as laid down in the PMG's "Handbook for the Guidance of Operators of Amateur Wireless Stations". Any breaches of these will lead to the disqualification of the operator concerned.

7. The arrangements of schedules for contacts on other bands will not be permitted.

8. All stations entering the contest will call "CQ RD" if using CW and "CQ Remembrance Day", subject to rules governing substitute operators.

9. A State competing for the trophy must submit a minimum of six (6) logs from financial members before becoming eligible for contesting the trophy.

10. Only one contact per station per band is permitted

SERIAL NUMBERS

11. Serial numbers to be exchanged during the contest will be as follows:—

(a) CW, the RST report followed by the serial number of the contact commencing with any number between 001 and 100 for the first contact, and increasing by one for each successive contact.

(b) Telephony, the RS report followed by a serial number as for CW contacts.

A complete exchange of serial numbers must take place before any points may be claimed for the contact.

12. In order that an equitable distribution of points for States with a large number of contestants and those with a small number, a sliding scale of points has been allotted.

13. In addition to the points in the scoring table that may be scored by a contestant, a bonus of 25 points may be added to the total score for each State worked on 56 Mcs. or above.

14. The log submitted must show in the following order: Date, Time, Band, Emission, Callsign, RST/no. sent, RST/no. received, Points Claimed. No log will be accepted unless set out in this order.

15. A statement signed by the operator must be attached stating that the regulations and these rules have been observed.

16. All logs must be forwarded through the Contestant's Divisional Council (for membership checking), to reach the Federal Contest Committee, Box 1234K, GPO, Adelaide, on or before September 8, 1956.

17. Attractive certificates will be awarded to the winners of the Telephony, CW, and Open Sections in each State; there will be no outright winner for Australia. Where a large number of logs are received from any one State, further certificates may be awarded at the discretion of the Contest Committee. The Open Section covers logs covering both phone and CW contact.

18. The State to which the Perpetual Trophy will be awarded shall be determined as follows:—

To the average of the top six (6) logs shall be added a bonus, arrived at by multiplying this average by the ratio of valid logs submitted by that State to the total of amateur licensees in the division at the time of the contest.

MINIMUM CONTACTS

19. The logs which will be accepted for the multiplier under rule 18 shall show at least five (5) contacts in the contest.

20. The trophy shall be held by the winning State for a period of 12 months.

21. The Federal Contest Committee shall be the sole adjudicators and their ruling will be binding in any case of dispute.

Scoring table:—

Contacts from VK1 to any State—6 points. Any State to VK1—6 points. (VK1 stations in ACT are classified at VK2.)

Contacts from VK2 to VK3—1 point, to VK4—2 points, VK5—3 points, VK6—5, VK7—4, VK8—6.

VK3 to VK2—1, VK4—3, VK5—2, VK6—5, VK7—4, VK9—6.

VK4 to VK2—1, VK3—2, VK5—3, VK6—6, VK7—5, VK9—4.

VK5 to VK2—2, VK3—1, VK4—3, VK6—5, VK7—4, VK9—6.

VK6 to VK2—1, VK3—2, VK4—4, VK5—3, VK7—5, VK9—6.

VK7 to VK2—2, VK3—1, VK4—4, VK5—3, VK6—5, VK9—6.

VK9 to VK2—1, VK3—2, VK4—3, VK5—4, VK6—5, VK7—6.

Amateurs throughout the Commonwealth are especially invited by the WIA to participate in the contest. It provides an opportunity to contact your interstate ex-service friends, join in the event and assist your division to win the coveted trophy.

DX NOTES

IN the DX field the "Yasme" expedition has caused considerable interest with Danny operating from VR1, FO8, ZC3, ZK1 and other rare prefixes. Currently there is rather a heated argument in progress concerning the QSL-ing arrangements from the "Yasme".

The original arrangement was that on receipt of one dollar with the incoming card, a reply would be sent airmail. If no dollar was enclosed, a card will be sent in reply via the QSL Bureau at the end of the trip, in approximately two years' time.

The proceeds of this QSL arrangement—money received in excess of the cost of an airmail reply—would be spent in purchasing new sails for the yacht.

Some amateurs forcibly expressed the opinion that this procedure is commercialising and corrupting amateur radio.

Dick Spencley, KV4AA, who has been responsible for publicity on the "Yasme" expedition recently announced that the previous QSL-ing system has been varied. Cards sent with the dollar enclosure will still be replied to immediately by airmail.

Other cards will be answered via the QSL Bureaux, practically immediately and should arrive in the normal period of about six months.

Another "DX-pedition", modern enjoyment of DX enthusiasts, is over, that of YVOAA's sojourn during late June to Birds Island. Located 180 miles off the South American continent, the operation was sponsored by the National Society of Venezuela and held during "Nation Week". The station was scheduled to operate on all bands from 3.5 through 28 Mcs.

As prior publicity emphasis was laid on the fact that YVOAA would only contact stations 10 Kcs. above and below their frequency.

YVOAA was only heard on 14 Mcs. at this location, for that matter, only rarely, due to the greatest "dogpile" of all time spread over 50 Kcs. on the band. Operators at the elusive station seemed to be unable to handle the mass of signals and 10 Kcs. up or down was forgotten. The improved propagation conditions did not help, and unless stations were parti-

.S.W. EMERGENCY NET IN ACTION

NSW Division's WIA Emergency Net once more in operation during late d early July, with floods prevailing in parts of the State.

irst request came for news from Bega far south of NSW, when normal com- on was disrupted. Col Fletcher, handling ABC news back to VK2WI, afterward Rod Pike, VK2ACU, of le, called VK2WI and, in view of a deterioration of the flood position, ar- for an emergency communications ser-

iately river levels did not rise to anti- heights.

most serious flooding occurred during lood on the Murrumbidgee at Wagga, many sections of the city were badly

VK2WI operated for some days on rgency. Alf Moye, VK2BW, of Wagga, d via the net that two AR2B transmitting- units be despatched for working in Councillors Ed Hulme, VK2EN, and Pickett, VK2AHP, who were with him VK2YC, at VK2WI, at the time. Im- y made arrangements for the despatch units.

n half an hour one unit was at Mascot me for transhipping to Wagga. Ansett fully co-operated, holding an aircraft period, and freighting the equipment free ee. The second unit was carried on the day.

initial unit was set up by Alf at Oura Station, 15 miles from Wagga, shortly afterward flood waters isolated the area and the AR2B supplying the only means of communication.

VK2BW, operating on the WIA emergency frequency of 7050 Kcs., acted at times as police control station, army base station, and handled PMG traffic.

He supplied communication for the State Emergency Services, and contacted two Army Ducks providing rescue services in the area. Alf was assisted by a number of amateurs. Jim Edge, VK2AJO, zone officer, and Hugh Stitt, VK2WH, were among the amateurs actively engaged in the operation.

Full co-operation with VK2WI was afforded by the State Emergency Services and other authorities, a valuable exercise ensuring the co-ordination of all services.

VK2WI was operated by Jim Corbin, VK2YC; Harry Pickett, VK2AHP, and Stan Bourke, VK2EL.

Later in the operation Hugh Stitt, VK2WH, was granted permission to act as base station for Forestry Mobile Units, using 3190 Kcs., and for some days relayed messages during the floods on the Lachlan River.

The NSW Division has six AR2B sets permanently located at strategic points around NSW, ready should any serious emergency occur. The VK2WI net acts as an official communications system for the NSW State Emergency Services.

Amateurs throughout Australia were officially thanked for their work in keeping 7050 Kcs clear during recent emergency working.

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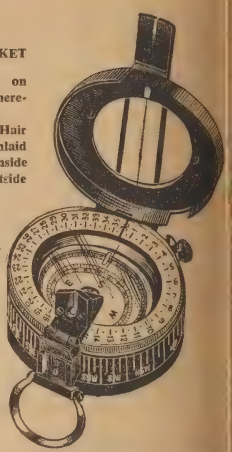
High Impedance 3000 Ohms . . . . . £1/5/- each.
Low Impedance . . . . . 12/6 each.
Packing and Postage: 3/6. Interstate: 4/6.

U.H.F. Klystron Assembly, 10C/ms . . . . . £3/-/- each.
Packing and Postage: 5/6. Interstate: 7/6.

CONDENSERS. 2 x .15 MFD, 8000v—27/6; .045 MFD, 1600v—27/6; 1 MFD, 1000v—5/-; 1 MFD, 700v—3/6; 4 MFD, 400v—3/6; 1 MFD, 600v—3/6; 2 MFD, 250v—2/6; .05 MFD, 600v—2/6. Plus Postage.

COMPASSES



OIL FILLED PRISMATIC POCKET COMPASSES.
Standard Army Type (as shown on right). The most accurate and therefore the best Compass available. Fitted with clear prism and Hair Line for taking bearings. Inlaid mother-of-pearl azimuth Scale. Inside calibration of 360 degrees, outside 32 points.

PRICE £12/10/-

Packing and Reg. Postage: 4/-:
Interstate: 5/-.

MOUNTING COMPASS, Type D.12.
An extremely accurate, American made, Compass, Liquid damped, needle type with adjustable azimuth circle, calibrated in degrees.
Ideal for all types of Boats. Dimensions: Dia. 7 ins. Depth 5 ins.

PRICE £4/10/-

Packing and Postage: 7/6.
Interstate: 10/6.

PUMPS

Long Reach IMMERSION FUEL PUMPS (illustrated on right).
Ideal for pumping all types of liquids. Particularly handy for transferring liquids from drum to tank. Pumps 400 gallons per hour. Powered by inbuilt 24 volt Motor.
Available in two sizes:—12 inch reach and 23 inch reach.

PRICE £5 Both types

Packing and Postage: 5/-. Interstate: 7/6.
THOMPSON FUEL PUMPS. Brand new in cartons. Pumping capacity 400 gallons per hour. Makes a first-class Bilge Pump for Boats, Small Irrigation System Pump, etc.

PRICE £3/17/6 each

Packing and Postage: 6/-. Interstate: 8/6.

MINERS' LAMPS

Ideal for all night work requiring two free hands. Complete with spillproof Nife Battery to give you 8 hours of continuous use. The perfect light for Spear Fishermen, Electricians working under houses, or in rafters, etc.

PRICE: Less Battery, 12/6 each.
Nife Battery only, 35/- each.
(2.5 volt 8 amp). Price (complete) 47/6 ea.
Packing and delivery to railhead 5/- extra.

SPOT LIGHTS

12 volt ALDIS SIGNALLING LAMPS. Makes an ideal Spotlight, Mooring Light, or Signal Light for emergencies. Fitted with rhodium plated reflector, Pistol grip handle with inbuilt trigger control, for operating lamp. In first-class condition.

PRICE £3/10/-

Packing and delivery to railhead 5/- extra.

TROUBLE LIGHTS

The ideal Car Trouble Light. Bayonet Socket. Single contact globe fitting, with wire cage and wooden handle. Complete with approx. 4 yds of 3-core flex and 3-pin plug.

PRICE 7/6 each

Postage and Packing: Interstate:

TELESCOPIC SIGHTS

Precision built, first-class SIGHTS, as used by British Army in Malaya.
4 power magnification, best quality Lenses, fitted with cross hairs, provision for altering focus. Weight 16 ozs. Length 11 inches.

PRICE £6/19/6

Packing and Postage: 3/6. Interstate: 5/-.

BATTERIES

Brand new in cartons, in original storage state. 24 volt 11 Amp Hour, lightweight, aircraft type.
American made. Ideal for Caravan Lighting, Small Ships' Lighting, etc.

PRICE 39/6 each

Packing and delivery to railhead 5/- extra.

w equipped in the way of an extremely
eiver and a few elements, it was
make contact.
mir of VK's worked YVOAA, including
d VK2ACX. In most cases they
ny hours calling before making the
ne of the better-known W stations
n the hunt, announcing their inten-
general call in the middle of the
Amateurs cannot keep away from the
X stations' frequency, these DX expedi-
ture activity must find some method
e frequency up and down the band;
o stations would be able to contact

n no announcement that Bird Island
epted as a new country for DXCC
s been made; the DX gang hope the
ll be favorable.
d South American expedition was con-
the Ecuador National Society, the
elebrate the 25th anniversary of the
f the organisation. On July 14, using
n HCIARE, the society operated sta-
he 6, 10, 15, 20, 40 and 80-metre
n a location right on the equator.
L cards will be sent to all stations
d
f amateur contacted in each of the
nts will receive a silver and marble
the National Monument in Quito.
r plaque will be attached to the monu-
s, giving details of the amateur radio
tivity.

ssian Amateurs

appears that the WAZ award is in
ain with UA, UB, &c., USSR stations
calls from the world's amateurs.
ly during June the restrictions on
ations contacting amateurs outside the
satellite countries were lifted. Most
rs, especially those licensed in recent
v appreciate the chance to contact a
new countries. Within the USSR
17 official countries and USSR ama-
nected to date promise to QSL.
QSL Bureau address appears to stand:
Moscow. The appearance of the Rus-
the possibility of a WAZ award has
me further DX interest. Incidentally,
Kyzyl, Tuva, is in Zone 23, the most
contact among the 40 zones.
rbert, G3ATU's "Month on the Air"
the RSGB Bulletin, contains a valu-
of W stations in "hard to contact"
hose working toward an ARRL WAS
l be interested in the following sta-
are active on 14 Mc.
rizona: W7AH, ANJ, JZ, JYZ, LBN,
VO, MAL, MLL, MPS, MNE, OPY,
PGX, RAB, RBF, SQA, TLG, TNW,
N, VKO, VMP, WFY, WKM, WNC,

W7ASA, GHT, HP, ITN, PAX, QC,
H VMF, VVC, VWS, WLT, WMO.

t: W7BSU, CJB, GVF, HCW, IBH,
VU LOD, OAZ, OSR, RSY, TAO,
E, TRB, TSM, TVK, QYA, VGZ,

W7BVZ, CX, JU, KEV, KJQ, MRN,
A, PST, SHY, SNP, RBV, TVF, VIU,
K7FDB.
W7EHF, FYR, IWH, KGP, MWR,
RH, ODJ, SOJ, TTM, UMT, VEW,
QC, WRV
g: W7GGG, HX, HYW, KPZ, LE,
NX, OME, PKX, PSO, QNR, TQO,

WIA NOTES

annual meeting of the VK5 Short-
e Listeners' Group, a section of the
ion of the WIA, the following office-
or the year were appointed:—President,
is; secretary, Len Cragen; treasurer,
liday, and publicity correspondent, Mac
Prior to the election, a special pre-
was made to group member John
for his effort in winning the VK/ZL
contest.
July a visit to BC station 5KA was
.
ave listeners in South Australia are
that the group meets at 8 pm on the
nday of each month at the Maugham
t Mission, Franklin St., Adelaide. An
to attend is extended to all interested
thusiasts

RER at the June meeting of the NSW
sion WIA was Mr. Gold, of the Civil
Organisation. He outlined CD schemes
ed definitely that radio amateurs would
l upon to assist in the communications
the administration. Mr. Gold explained
ough the possibility of an attack was
preparation of a suitable scheme could
ny thousands of lives. It is hoped
a future date Major-General Dougherty
ure to the division on other aspects
Defence.

IARU CONVENTION

IMPORTANT meeting in amateur radio affairs was the June IARU European (Region 1) convention, held at Stresa, Italy. During the six days all phases of hobby activity were discussed. National societies in Europe are well organised in the international sphere since the 25th anniversary meeting of the IARU, held at Paris six years ago. The major result to date is that societies in general enjoy better relations with their own licensing authorities, gained by the liaison and exchange of ideas between amateur bodies.

The Stresa conference was divided into two sections. The Technical Committee discussing intruders in the bands, occupancy, VHF development, TVI, &c., while the administrative section arranged proper representation for IARU (Region 1) at the next International Telecommunications Conference, and the possibility of participation at the CCIR Conference at Warsaw, to be held later this year.

Representatives from all European societies attended; the HQ society, the ARRL, sent IARU secretary, Mr. A. L. Budlong, and Mr. John Hutton, assistant-secretary of the ARRL.

The detailed decisions of the conference will be awaited with interest.

TELEVISION

INTERESTING point that arose during recent TVI discussions was the statement by the Postmaster-General, Mr. Cameron, that the introduction of regulations to control interference by modifying electrical equipment was a matter for State Governments. Legislation of this type was outside the powers of the Commonwealth and must be enacted by State authorities. Judging from the terrific din caused on normal broadcast receivers by modern automatic irons, beaters, &c., action will have to be taken along similar lines to overseas.

According to a recent Press announcement that television will be with us in Sydney from mid-September, commercial station TCN will transmit programs for a limited period each week, approximately 15 hours. It does not leave much time to solve the TVI problems of the present rig, certainly not enough to build the rather complicated TVI-proofed transmitters.

The first trials of TCN were conducted in July

SUNSPOT ACTIVITY

PROPAGATION conditions on 14 Mcs. have been excellent during June and early July, a reminder of what is likely to be experienced over the next few years. Maximum sunspots have their disadvantages, however, with ionospheric disturbances and the resultant fade-outs.

A number of amateurs are finding their receivers can no longer cope with the mass of signals appearing on the band.

21 Mcs. is rather disappointing and the number of signals anticipated are not appearing on the band.

It is difficult to decide whether this is due to the conditions or lack of population in this amateur allocation.

A HELPING HAND

PUBLICITY is currently being given to the Radio Amateur Invalid and Bedside Club formed in England in 1954.

The main objective is to assist those less fortunate in maintaining their interest in the hobby and to give them Morse and theory instruction as required. Amateurs can be provided they assist in this type of work. Applications should be made to Bill Harris, G3DH, 25 Playford Lane, Rushford, Ipswich, England.

EARTH SATELLITE

JULY QST runs a story on the possibility of radio amateurs tracking the path of the first man-made Earth's Satellite. It is anticipated the satellite will be launched in approximately 12 months and will carry a transmitter operating on 108 Mcs. A suitable high-gain beam antenna, at least twelve elements plus a normal communications receiver and converter, would be sufficient for plotting. Full details of equipment and the proposed program are covered in the article.

Current visitor to the US is well-known DX-er KH6IJ; he will be operating portable from various parts of the country. He was interviewed by Bill Leonard, W2SKE, on the Voice of America amateur radio session, and spoke of his DX activity. The secret of the large country tally was, as usual, antenna, power and excellent location, plus, of course, more than average operating ability.

Amateur experiments in the UK are stretching out with their television transmissions and are covering up to 30 miles. A number of amateur stations transmit short programs, generally using amateur movie-films.

The transistor transmitting record is believed to be up to 800 miles, when G3CSZ was heard in Prague on the 160-metre band.

A.O.C.P. CLASS

The W.I.A., Victorian Division, A.O.C.P. Class will commence on Thursday, 26th July, 1956. Morse and Regulations are held on Thursday and Theory on Monday evenings from 8 to 10 p.m. Persons desirous of being enrolled should communicate with the Secretary W.I.A., Victorian Division, 191 Queen Street, Melbourne (Phone MY1087 from 10 a.m to 4 p.m.), or the Class Manager on either of the above evenings.

MAKE POUNDS A WEEK

In spare time or start full time business. Many making £20, £30 and £40 a week. Write for details of Guaranteed Money-Making Plans. J. O'Rourke, Director Profitable Enterprises (reg.), Dept. RH, Box 5070, G.P.O., Sydney.

AWA RONETTE

MICROPHONES & ACCESSORIES

Type RFC5
£14/17/6
(High impedance)
Type RFC5/L
£18/19/3
(Low impedance, 200 ohms.)

Technical pamphlets will be mailed on request. Other types also available from

Noyes Bros.
252 Argyle St., Hobart.
and leading wholesalers

ACTUAL RECORDING OF THE WHITE CITY STADIUM "Searchlight Tattoo" 1954

10" H.M.V. L.P. ODLP.1050

Here is the recording which will appeal to all lovers of Military pageant and martial music. It features Massed Military Bands of the Royal Air Force, the Royal Marines and the Massed Pipe Bands of the Scots Guards, with many well-known items.

AT ALL RECORD RETAILERS

CH.482.4

NEW VALVES

1H5 .. .. 9/6	6K8G 11/6	6F6 .. .. 9/6	EBC33 .. ..
1Q5 .. .. 9/6	EK32 .. .. 15/-	807 .. .. 12/6	AV11 .. ..
1T4 .. .. 9/6	6J8 .. .. 15/-	EL32 .. .. 9/6	EZ82 .. ..
1R5 .. .. 15/-	6K7 .. .. 7/6	12A6 .. .. 12/6	117N7 .. ..
1S5 .. .. 15/-	KTW62/6U7 .. .. 7/6	6J7 .. .. 8/6	4307A .. ..
3S4 .. .. 15/-	EF8 .. .. 9/6	6SL7 .. .. 10/6	5Y3GT .. ..
3V4 .. .. 15/-	7C7 .. .. 3/6	6SN7 .. .. 10/6	12SR7 .. ..
1K5 .. .. 2/6	7A6 .. .. 3/6	954 .. .. 5/6	1H6 .. ..
1L5 .. .. 9/6	78 .. .. 7/6	955 .. .. 5/6	1J6 .. ..
1C7 .. .. 9/6	6J6 .. .. 12/6	VR150 .. .. 15/-	1D8GT .. .. ..
6U7G 7/6	6AG5 .. .. 10/6	VR65A 2/6	1D5 .. ..
6G8G 11/6			

ALL VALVE PRICES PLUS POSTAGE

NEW SWITCHES

Yaxley 3 x 3 SB 3/3
Oak 3 x 2 2B 4/6
Alpha DP/DT 3/3
Oak 1 x 2 SB 1/9
Oak 1 x 3 SB 2/-
Post extra

NEW VALVE SOCKETS

5 or small 7 pin amphenol ceramic with mounting 2/9
8 pin teletron moulded per doz. bakelite 5/6
8 pin loctal moulded per doz. 6/6
6 pin wafer per doz. 3/6
9 pin innoval wafer per doz. .. 10/-
7 pin miniature, pr. doz. 15/-
Post extra

GENERATORS

12 volt 500 watt tested in good order .. .. £3/10/- F.O.R.

BUZZERS

Buzzer, variable note, works off 3 volt battery 7/6

SELSYN-MOTORS

New American selsyn motors 50 volt transmitter or slave. Small. £2/17/6.
Slave only .. .. £1/17/6.

OIL FILLED PAPER CONDENSERS

15mfd. 600v. 10/-
8mfd. tapped at 5mfd. 110v. AC 7/6
1mfd. 400v. 2/9
.01mfd. 500v. 7/6
3MF 2000v. 17/6
.1 x .1 400v. 2/6
Post extra

SUPPRESSOR CONDENSERS

.25mfd. 240v. AC working .. 2/6
.01 x .02mfd. 240v. AC working 2/9
Post extra

MIDGET CONDENSERS

Seven plate midget condenser, ceramic insulation, standard single hole mounting ¼in spindle 0-30pf. .. 5/6

METAL RECTIFIERS

90 volt 200m.a. metal rectifier, suitable for operating relays, etc., 9/6

THROAT MICROPHONES

New American throat mikes.
Per pair 3/6

SIGNAL LAMP GLOBES

Lucus signalling lamp globes, 10v. 6/- per doz.
PRE-FOCUS GLOBES
12v. 420 watt 7/6
Post extra

CREED-RELAYS

New creed relays supplied with mounting base, £3/10/-.

MICROPHONE TRANSFORMERS

Carbon microphone transformers, new, 4/6.
Post extra

BUTTERFLY CONDENS

60pf. x 60pf. butterfly conde 8/6.
Post extra

TUNING CONDENSER

Two gang "H" tuning conde 10/6.
Three gang, 15/-
Post extra

I.R.C. WIRE-WOUN RESISTORS

2,500 ohms. 5 watt 1/6 or 10/-
5,000 ohm. 5 watt 5% 1/6 e 10/- per doz.
4,800 ohm. 5 watt 5% 1/6 e 10/- per doz.
200 ohm. 20 watt 10% 2/3 e 15/- per doz.
5,000 ohm. 20 watt 5% 2/6 e 20/- per doz.
1,000 ohms. 20W 2/6 ea. or 20/-
750 ohm. 30 watt 5% 2/6 e 20/- per doz.

PRECISION RESISTOR

I.R.C. precision wire wound res 1%. Available in the foll values:— 20k, 30k, 50k, .15m, .25m, .5m and 1m.
10/- each.

NEW METERS

10m.a. 2½in flush mounting m American, 15/-.
English Tuner 3in flush mou meters, 10m.a. 20/-.
English 0-600v. with shunt mounting, 20/-. Post

NEW B.S.R. MOTORS

These English B.S.R. Motors as used on most tape decks, also have many other uses. Size of motor 3in x 2½in x 2½in with 3/16in shaft, for 240 or 110 volt AC operation. NEW 39/6
Post, N.S.W., 3/-. Interstate 4/6.
Used, but in good condition 27/6

LINE FILTERS

Cut out that electrical interference with these line fi
For use on AC or DC equipment, 12 volts to 110 volts .. ..

New American Telephone Wire Clearance. Rubber-insulated with stainless steel and copper conductors supplied on metal reels each containing half a mile of wire. ½-mile reels NOW 15/- In case lots—6 reels (3 miles) NOW £4

PUSH-BUTTON SWITCHES

Four pole push-button switches 20/-
Two control box fitted with above switch also 5 bezels with globes & multi contact key switch.
Post N.S.W. 2/-
Interstate 3/-

A.C. AMP METERS

A.C. Amp. Meters (ex-County Council). A necessity in any electricity workshop.
RANGE: 0-5 amps. (can be extended by shunts).
DIAMETER: 7½ inches **28/6**
Postage extra—N.S.W. 6/6. Interstate 11/6.

NEW-RT34 APS13

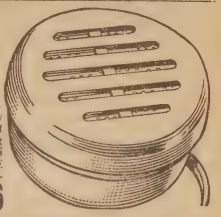
TAIL-END CHARLIE

Valve 420 Meg, Transmitter Receiver Gene Powered
5-6J6, 9-AG5, 1VR150, 2-2D2
£8/10/-
LESS VALVES AND GENEMOTOR £3/15/-

PILLO-FONE

EXTENSION UNIT

IT'S A REAL MINIATURE WITH ROLA UNIT.

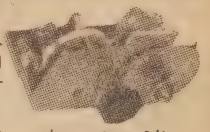


Install it anywhere, in the sick-room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½in Diameter by 1¾in deep.
POST FREE **22/6**

H.F. Tuning-Unit

These H.F. tuning units which are suitable for the 144Mc band contain three ganged tuned coils, 7 plate ceramic trimming condensers, three acorn sockets (ceramic) and 3 new 954 acorn valves.
25/-
PLUS POSTAGE

H. F. OSCILLATOR



Small H.F. oscillator suitable for conversion to the 144mc. Band complete with split stator condenser, vernier dial and 955 acorn valve and socket .. .. .. **25/-** plus postage 2/6

RELAY-TYPE COUNTERS

("Mercury" American Made) These relay counters register from 0 to 99,999. Can be supplied with 250ohm, or 5,000ohm coils.
25/-
Plus Postage

P.M.G. TYPE RELAY-COUNTER

0-9,999
100 ohm coil **15/-**

FOUR VALVE AMPLIFIER

Four valve audio amplifier, made in America. Supplied with two 7C5, one 7F7 and one 7Y4 valves, trans. res. etc. mounted in brocaded finished case.
38/6 Post N.S.W. 5/6 Int. 7/6

24-VOLT MIDGET MOTORS SHUNT WOUND

Fully Laminated Fields, Wound Armature. Sixteen Segment Commutator, ball-bearing Armature. Ideal for Model Trains, Hobbyists, etc. Condition New.
Price, each **32/6**
Packing and postage: NSW 1/6: Interstate 2/6.

Transformer and metal rectifier to operate either of above. From 240V AC 30/-. Plus postage.

NEW FLEXIBLE DRIVES

Flexible drives to suit command transmitters or receivers
5ft 6in long .. .. **10/-** Plus postage.
To suit compass receivers 2ft long .. .. **10/6** Plus postage.

NEW UNIVERSAL-MULTIMETER

Manufactured by Robinson Electronics Laboratories, Incorporating 4½in World Famous American Weston Meter and High Stability Resistors.

This high-grade instrument is fitted in a durable and attractive Hammerton-finished case with self-contained batteries and supplied complete with test prods.

D.C. Ranges	A.C. Ranges	D.C. Current Ranges	Resistance Ranges	Output Ranges	PRICE
0-12V	0-12V	0-1.5MA	0-5,000 ohms	0-12V	£12/17/6
0-60V	0-60V	0-12MA	0-50,000 ohms	0-60V	Plus 12/6
0-300V	0-300V	0-60MA	0-500,000 ohms	0-300V	PACKING &
0-1,200V	0-1,200V	0-300MA			POSTAGE

Also Decibel Scale—18 to plus 5db

METROPOLITAN RADIO SUPPLIES

640 KING STREET, ST. PETERS, N.S.W.
PHONE LA6087

479 PARRAMATTA ROAD, LEICHHARDT, N.S.W.
PHONE LM3610

SPECIAL PURCHASE

LIQUIDATION STOCK

NEW 3-SPEED RECORD-CHANGERS AND PLAYERS — CURRENT MODELS

STORMBERG-CARLSON VELVET ACTION 3-SPEED CHANGERS

MODELS 104 or NCI

Both with turn-over Crystal Pick-up.

£11/17/6 F.O.R.

ENGLISH B.S.R. 3-SPEED PLAYERS—MODEL GU4A

With turn-over Crystal Pick-up. Finished in Cream and Brown.

£8/17/6 Plus Postage Packing N.S.W. 9/6 Int. 18/6

MICA CONDENSERS

Standard Mica Condensers, small current types .00003 to .005 including most wanted values

25/- Per 100

Postage 1/6

Electrolytic Condensers

12mfd 525V	4/6
24mfd 350V	3/3
30mfd 350V	3/6
500mfd 12V	3/3
8mfd 350V	2/6
10mfd 40V	1/6
8mfd 525V (miniature)	4/6

(plus postage)

12-inch P.M. Speakers

Heavy duty 12in per-mag speaker by well-known manufacturer. 10T, CT, or 5,000 Transformer **£2/17/6**

Postage: N.S.W., 5/6—Interstate, 7/6

I.F. TRANSFORMERS

Standard I.F. transformers, square can (1⅜) 455K.C. permatuned **4/3**

(plus postage)

CONDENSER SPECIAL

Boxes of 100 new mica paper and electrolytic condensors in valves ranging from 50pf. mica to 5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 10 mfd/40v, 8mfd/52v, 16mfd/350v electrolytics.

30/- PER 100

POST EXTRA N.S.W. 2/6 INT. 3/6

CARBON RESISTORS

Color Code Card Supplied

Well-known make of carbon resistors in values of 100 ohms to 5 megohm. In 1-watt, ½-watt and 1/3-watt. All resistors are standard color-coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt. **8/6**

Price—Box of 100

Postage 1/6.

ALL GOODS ADVERTISED ON THIS PAGE ARE NEW

OVAL SPEAKERS

(6/9H) 9" x 6" per mag Speaker with 5T Transformer **£1/15/-**

MIDGET SPEAKERS

(5F) 5" per mag with 7T Transformer **£1/14/-**

5" Dynamic 1,500 ohm Field 7T Transformer **£1/17/6**

Post and packing on speakers, N.S.W. 4/6 — INTERSTATE 5/6.

Dynamic Speakers

7in Dynamic speakers by leading manufacturer, 1,500 ohm Field Coil, 7,000 ohm Transformer

or

Ovaltone Dynamic Speaker 9in x 6in 1,000 ohm Field 5,000 or 7,000 ohm Transformer

25/- EACH

Postage N.S.W., 3/9—Interstate 5/9

I.R.C. RESISTORS

100 I.R.C. carbon resistors, ½, 1 & 2 watt, in values 50 ohm to 5 meg. including many popular sizes, 3T, 15T, 20T, 25T, 50T, 100T, 250T, 500T, etc.

(Standard resistor color code supplied.)

Box of 100. **18/6**

(Plus 1/6 postage.)

NEW VIBRATORS

6 volt A.W.A. gas-filled vibrators. Heavy duty synchronous **NOW 7/6 or 70/- per doz.**

HOOK-UP WIRE

(10—, 010)

Rubber-covered—**6/9** 100ft.

Rubber and glazed Cotton puush back **10/-** 100ft

Glass insulted **8/6** 100ft

Postage extra

MERCURY SWITCHES

The switch with a 1000 uses 2/6 Postage 6d.

SAPPHIRE NEEDLES

Rothermel sapphire needles play 2000 recordings. Made in England. Each **2/9** or **25/-** dozen.

POTENTIOMETERS

Standard ½ or 1 meg. switch pots long spindle d/p switch	6/6
½ meg. or 2ST. ohms short spindle switch pots.	2/6
½ meg. or 100T standard pots long spindle.	3/6
½ meg. or 100T short spindle	1/9

All plus postage.

Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.

METROPOLITAN RADIO SUPPLIES

640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087

479 PARRAMATTA ROAD, LEICHHARDT, N.S.W. PHONE LM3610

...LDING OUR NEW PHOTO TIMER

(Continued from page 39)

...ge — if necessary by adding small ...le values to one or two of them. ...ration control can then be used ...al the appropriate overall correc-

...n bridge is available, the position ...e to be assessed on the perform- ... the timer, after completion. ...e if the shorter time intervals are ...r, when the longer intervals have ...s up by the calibration control, it ...mean that the 4mfd capacitor is ...olerance. Add capacitance in ...le with it, reset the calibration con- ...n check again.

...rsely, if the shorter intervals are ...t, when the calibration control ...en set for the longer ranges, it ...indicate that the 4mfd capacitor ...t its marked value. Since the value ...t be reduced, the only possible ...ve is to pad up the smaller ...rs till the time intervals which ...ermine are right.

...ourse, it may happen that only ... the smaller value capacitors ...r to be out. If its intervals are too ...e capacitor can be brought up ...alleling others across it. If the ...s are too long, the capacitor can ...e replaced or else the others ...up to match it and correction ...y the calibration control.

...ust a matter of which is the

...RX. FIGURES

...st be remembered when calibra- ...unit that the figures shown on ...give only the number of whole ...or, at best, the first decimal, of ...al time interval. But since each ...ve number is root 2 times the ...one, and root 2 is 1.414 . . ., the ...periods may be correspondingly ...by the amount of the decimals.

For simplicity's sake, the dial figures have been rounded off to the nearest logical value. Hence the apparent error that twice 22 is 45.

Calibration completed, the timer is fitted into the cabinet, taking care not to knock the calibration control at the rear out of adjustment. Because the instrument is to be used in the darkroom —a typical earthed situation—particular care should also be taken in the earthing of the instrument.

Only three-core flex should be used to connect the timer to the mains, and the green wire securely bonded to both the chassis and the earth pin of the plug.

The earth pin of the outlet socket should also be connected to this wire.

HOW TO OPERATE

In practical use, the enlarger switch is removed, the enlarger connected directly to the timer by means of a plug, and the timer connected to the mains. The timer can be operated by means of the start switch on the panel, or by connecting a foot switch or other convenient remote control into the tipjacks. The remote control does not handle the mains voltage and is therefore completely safe.

Initially, the manual-automatic switch is set to the manual position and the enlarger focused in the normal manner. The switch is then returned to the automatic position, and the dial set to the required exposure time, which will be determined by the quality of the negative, the enlarging factor and the speed of the paper used.

Pressing down the start switch will not affect the timing cycle, but the timer will not repeat the cycle while ever the switch is depressed. In the case of extremely long exposures, when a repetition of the cycle is required, the switch should be released for a short period, before the second cycle is started

Test strips are particularly easy to make with the timer. The provision of "readymade" exposures having the correct relationship, and which are available at the touch of a switch, eliminates a great deal of the wasted time and effort normally associated with this chore. As a result, one is less tempted to bypass this necessary but otherwise tedious operation.

Furthermore, once the correct exposure is determined, there should be no difficulty in repeating the required exposure as many times as may be required —and always with a high degree of accuracy, even for very short times.

Thus, the timer will eliminate at least one of the variables encountered in photographic work—human inaccuracy —and thus improve the quality of amateur pictures, a goal toward which every amateur photographer strives.

...ITTLE GENERAL" FOR 1956

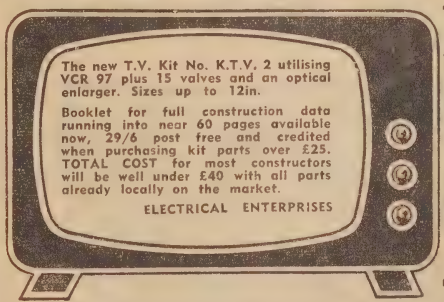
(ontinued from Page 67)

...have already been adjusted as ...d last month, the set should be ...o its top performance. If you ...ain the services of someone with ...rator to do the alignment for ...st results will be assured.

...ever, it would be best to wait ...e set is in a cabinet with a dial ...tackling the job on this basis. In ...antime, you can fiddle with these ...ents (but not the IF trans- ...) to your heart's content.

...should be enough for this month. ...onth we will describe an attrac- ...inet to house the set, along with ...ails to enable anyone with a ...m of woodworking skill to build ...elf. We will also describe how to ...ilter choke to the power supply; ...ement which will appeal to those ...ant the lowest possible hum level.

...T MONTH: Building the ..., final alignment.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OM THE SERVICEMAN WHO TELLS

(Continued from page 59)

" the 6X4 rectifier. It was easy nce the meter had led me to h I am still at a loss to explain happened. It is the first I have red, though by no means the ave heard about. A couple of es have experienced similar and one suggested that the of plate and cathode connec- adjacent pins was asking for Maybe he's right; but I won't that argument.

ver, quite apart from why it d, it was clear that the socket ave to come out. This wasn't y easy, partly because it was ell overgrown with other com- partly because it was rivetted partly because I still had to do with twisted pigtails; with the esent risk of breaking one off

SOCKET

I finally managed it without any new problems and fitted socket, a mica filled type this the hope that it might provide in of safety. After soldering ls back in place and replacing ponents above it I was ready ther test.

set worked this time, though it rather weak for this particular normally renowned for its high ity. A check on the HT voltage owed why. It was well down. ittle over 100 volts. Considering t this would have on vital screen the poor performance was ndable.

cked the rectifier as a matter of but it appeared to be OK so I to the vibrator. I had no way wing whether it was old or new, it should have failed or not, nply plugged in a new one. The rose to nearly 200 which, allow- r higher battery voltage when would be much nearer the The sensitivity made a similar nd now left little to be desired.

e was only one obvious fault he volume control was showing f noise. Not a great deal, just it to indicate that it was on the ut. Remembering the owner's ions I had no hesitation in g it.

Y AGAIN

had its tricky moment also, be- nidget type with the usual switch, feedback tapping, but nothing e valve socket or the HT line. a general check-over and align- could find nothing more wrong, ontacted the owner and arranged it back in the car.

ough I fancy I could have left him I particularly wanted to the ignition interference of which d spoken. If it was, in fact, n interference it should still be present, since nothing I had done should have affected it.

Accordingly the owner brought his car around to the shop and we tackled it jointly. After forcing myself into the usual awkward positions, and with the owner's help, I eventually mounted it back in place, plugged in the speaker, aerial, and power and switched on. At this stage the performance left little room for complaint, several of the more powerful country stations being easily read, even without the aerial extended.

IGNITION HASH

But now came the crucial test. I switched on the ignition and pressed the starter. The speaker immediately gave forth the rythmic clicks of the ignition pulses and these were audible on all but the strongest stations. There was one consolation; to be as bad as that the system had to have a pretty definite fault somewhere.

Hopefully I turned to the spot where the majority of such faults are found; the base of the aerial and, more particularly, the bonding between the outer screen on the aerial cable and the frame of the car. The ohmmeter connected between these two points told a strange story; about 50 ohms resistance. This puzzled me somewhat. I was prepared for either negligible resistance or open circuit, but what would cause 50 ohms?

The aerial was a cowl mounting variety on the passenger side, which is just a polite way of saying that the underside was located in an almost inaccessible spot above the glove box. By developing something like an extra joint in one forearm I was just able to get a spanner on to the main nut holding the assembly together. But I had no room to turn it.

TROUBLE REVEALED

The owner saved the day by managing to unscrew things from the top, while I hung onto the spanner and nut. When the thing eventually fell to pieces I could see where my 50 ohms were coming from. The appropriate area around the mounting hole had been cleaned when the aerial was installed but was now completely covered with fine rust.

I mentioned this to the owner and watched daylight dawn as he recalled the probable reason. It seemed that some months previously the original aerial had been wrecked by vandals while the car was parked (doubtless some "poor mixed up kids" with nothing better to do).

Anyway, the owner had bought a new aerial and, being a handy type, had fitted it himself. Unfortunately he must have missed out somewhere, because the first shower of rain had let in quite a lot of water. So he had tackled it again, this time making a satisfactory job of it.

But the damage had been done. Enough rain had entered to thoroughly wet the cleaned metal area and set up rust. From then on it was only a matter of time.

Of more practical interest was how to clean it. I normally use a wire brush in the chuck of a power drill for this job (the type of brush used for decarbonising is ideal) but I had no chance of getting this combination anywhere near the spot. I tried a piece of emery, but it was obvious that I couldn't exert the necessary pressure. Finally I told the owner there was only one thing for it; the glove box would have to come out.

We tackled the thing with a screwdriver apiece, taking out dozens of self tapping screws and removing fancy trimming, metal cover strips, &c. Finally the glove box slipped out and the way was clear.

It needed only a few seconds then to produce a clean metal surface, after which we re-assembled the aerial and I made another resistance check. As I had hoped, the ohms had vanished. Then I tried the motor again. The improvement was quite dramatic, the ignition noise having virtually vanished. Only with everything flat out between stations was there any evidence of it, and even then it was almost drowned by the normal atmospheric noise level. I reasoned that any signal that weak would not be worth worrying about.

LEAVE IT TO ME!

The owner was quite impressed and when he saw me ruefully surveying the bits and pieces of glove box and trimming, still to be replaced, he grinned. "Don't worry about it," he said, "I can fix that up at home. It's been worth it to get the set going properly again."

I took him at his word, collected my fee, and sent him on his way. I must admit I felt a certain amount of satisfaction and pleasure over the job — until I remembered the fellow who had twisted the pigtails around the socket lugs. Then I muttered a rude word and sat down to write these notes.

I can only thank my lucky stars that the little overseas gadget for making twisted, solderless joints has not been introduced into local radio factories. As sure as eggs, some local egg would apply solder to the joint—just for good measure!

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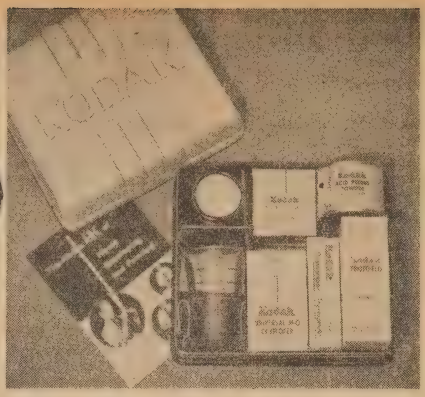

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A NEW "PERSONA TV RECEIVER

(Continued from Page 91)

The sync. separation circuits ar extremely simple, being concentra two triode sections which are "left from the IF and video channel a discussed.

The sync. impulses produced a to more or less conventional def circuits, the line sweep also pro EHT, in the usual fashion.

In the power supply, metal re are used, so that the total valve plement is not increased thereby all, ten valves are used, over and the picture tube, but seven of the are multiple types filling at lea functions.

Power load of the complete re at 110 volts AC is 90 watts.

For servicing, the removal of a of screws allows the chassis and tube to be withdrawn completely th the front of the case.

Removal of additional screws allows the chassis to be brok half, as illustrated in the accompa photograph.

Though the receiver is intend give a scaled-down performance in to average areas, the degree to the circuit has been simplified is esting. It could show the way t plified and cheaper sets using large ture tubes — a demand that ma come very evident locally.

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AMPLIFIERS

(Continued from page 81)

tg. of the vertical amplifier is
pp'd to them in order to make
tp of the amplifier as effective
fit. Reducing the voltage makes
e ier for the amplifier, but for
P we consider that 1000 volts is
t minimum which will give
th results with at least 1500
od figure to aim at.

m in mind these requirements
t work with the published curves
e AC7 and the manufacturers'
u voltage and dissipation figures
what could be done.

ll-known "long tailed pair" cir-
Te the advantages of simplicity
m inherent distortion.

STAGE

tput stage of the amplifier was
to the oscilloscope, connection
deflector plates being made via
panel terminals. A signal
was fed direct into the grid
the upper of the output valves.
late load resistance values were
the maximum output voltage
pc frequency points noted.

effort was made to keep the
capacitance between the plate
ring and earth small.

diameter hole was drilled in
is near each of the 6AC7 plate
the bulky 0.25 mfd coupling
mounted above the chassis
ey could be well away from
and at the same time not
ith the input circuits.

he coupling capacitors the con-
ads were run about ½in above
is to another pair of holes just
e connecting terminals. Return
ng to the plates of the 5BP1
und with their corresponding
leads, the shift potentials being
p on the way. The leads on
side of the 2.0 meg resistors
e as short as possible.

with these precautions, the fre-
response curves indicate that
capacitance to earth from each
plate is about 40 pf.

bject is at least a 1 Mc 70.7 pc point with compensation and with consideration to standard resistor sizes and dissipations, the most suitable value of plate load resistor is 6600 ohms made up of two 3300 ohm one-watt resistors in series or a single 6800 ohm 2-watt resistor.

The highest voltage we recommend that you apply to the amplifier with the constants given is 320 volts. Under this condition the amplifier will perform acceptably with a 5BP1 and a 2000-volt supply.

COMPENSATION

The next job is to arrive at a suitable value for the peaking inductor. Our opinion is that a Q of 0.5, which allows a very small amount of overshoot (3 pc), is a good choice. The compensating inductor therefore is required to have a reactance of 3300 ohms at about 0.6 Mc. A simple calculation will verify that the value is approx. 875 uH.

Bear in mind that this value applies only to the particular case. If the shunt capacitance happens to be lower than in our case, an inductor of 875 uH would cause a peak in the frequency response curve.

You are then in the advantageous position of being able to use a smaller inductor and achieve a wider frequency response.

The physical form of the inductor is not particularly important since the true Q of the resulting circuit is low. The coil can be wound on a cardboard former or a few layers can be removed from one of the standard small RF chokes. We found that the correct inductance could be obtained if 15 layers were removed from the Q-Plus RF choke type RFC1.

ALTERNATIVE METHOD

If you are working on an oscilloscope which is substantially different to ours, the following method suggested by Terman (see references) allows the correct compensation to be obtained with the aid of a signal generator and a simple calculation.

By experiment, choose Rc so that the response is 70 pc of the mid frequency response at the upper frequency at which the response is required to be level. Let this be f.

Shortcircuit Rc and insert the peaking inductor, adding or subtracting turns until the tuned amplifier shows a peak at a frequency equal to f divided by the square root of Q. In this case Q corresponds to the desired characteristics as given in Figure 6. We suggest that you choose Q equal to 0.5 in which case its square root is near enough to 0.7.

With this method no inductances need to be measured. If the resulting amplifier does not allow satisfactory deflection to be obtained without distortion, you will have to increase Rc and be satisfied with a lower upper frequency.

Returning now to the present amplifier design, the input voltage to the grid of the output stage for full output is too high for work on the low level sections of TV receivers and therefore another stage of amplification is required.

This stage is also the most convenient for the inclusion of the low frequency compensation circuit. After fixing the value of the additional load resistance, the value of the capacitor

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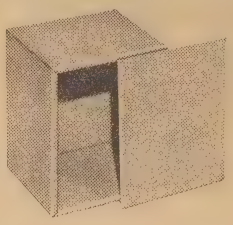

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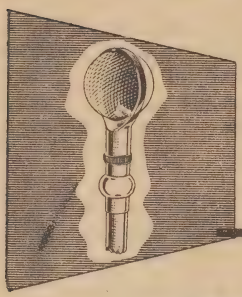
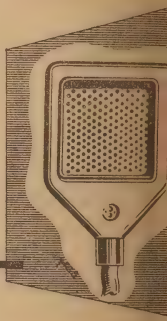


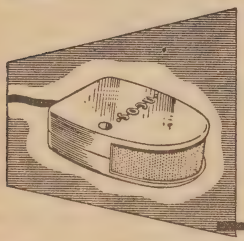
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**

HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



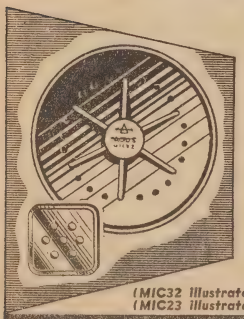


LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6.**

GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**

CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as 1/8 in. square to 1-1/8 in. round, with various thicknesses from 3/16 in. to 5/8 in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

(MIC32 illustrated)
(MIC23 illustrated)

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hosen by observing the perform-
f the amplifier on 25 cps square
A value of 2.0 mfd is the
t standard value that can be
without causing a peak within
nge.
overall low frequency perform-
f the amplifier is then very good.
, in fact, reproduce a 25 cps
wave with only a 10 pc droop.

NUATOR

amplifier stage gives sufficient
ut it is also necessary to provide
rying input voltages. A resist-
enuator with capacitive compen-
placed in the grid circuit is worth
ring, but would be fairly com-
ad if a sufficient number of steps
ow for all possible conditions
ncluded.
additional 6AC7 operated as a
e follower provides a solution
it allows a low resistance gain
l to be included in the cathode
. The output impedance of the
e follower and the resistance of
in control are both so low that
fect of stray shunt capacitances
e neglected. A wire wound con-
ay be used and the effects of
ductance of the resistance element
eglected.
mall resistance is placed at the
end of the control to limit the
num attenuation and allow the
d to be calibrated accurately over
ge of 10 to 1. This system has
vantages that it allows quite ac-
voltage readings to be made from
reen of the CRT when the gain
ol knob is set to one of the cali-
n marks and at the same time it
the height of the pattern to be
uously varied when you are not
ularly interested in the precise
tude of the signal.

T IMPEDANCE

the same time the input of the
le follower provides a high im-
ce circuit into which the resistive
uator can work. We have chosen
ple four position attenuator which
es an attenuation of 1000 to 1
nly requires two adjustments. The
rs making up the attenuator could
be high stability types and in any
it is worth while checking their
s in the interests of accuracy.
ere a standard resistor of the re-
d valve is not available it may be
sary to make up the value from two
er resistors in series.
m the circuit you will note that
esistive component of the input im-
nce is 10 megohms in all positions
t the "X0.1" position where it is
negs.
e capacitive compensation is easiest
just with the aid of a square wave
rator. Quite a definite adjustment
be obtained even at 1000 cps.
cut-down trimmer should be con-
d across the 10-meg resistor and
tting should be such as to give best
re wave response with the attenuator
o the "X10" position. Then, with
attenuator set to the "X1" position
3-30 pf trimmer should be adjusted
ive the best results.
nally, check the behavior of the am-
r with the control in the "X100"
ion to make sure that the .0047
capacitor is optimum.. If in error
r a series or a parallel capacitor
be needed.

Failing a square-wave generator, a signal generator with an attenuator could be used. With this procedure, it would be wise to check that the ratios are correct at several frequencies.

A convenient source of voltage for checking the calibration of the vertical amplifier is the 50 cps terminal on the front panel. The 6.3 volts rms corresponds to 17.6 volts peak-to-peak. It could most conveniently be read on the "X10" scale with the continuously variable attenuator set to "2". A special mark could well be included on the calibrated graticule.

It is worth noting that most published waveforms in receivers manufacturers' data is given in peak-to-peak values and it is wisest to calibrate your instrument in these terms. Accuracy to plus or minus 10 pc is usually good enough.

Incidentally, the vertical input and earth terminals as marked on our standard panel should be interchanged in order to avoid having the input and output terminals of the amplifier alongside one another. Also a metal shield should be placed between the output terminals and the attenuator network inside the chassis so that there is no interaction between the high and low level circuits.

So much for a brief discussion of the major points of interest in the amplifier circuit.

FUTURE DEVELOPMENTS

Although the input impedance of the oscilloscope is very high, it is still not a substitute for a cathode follower probe. A low capacitance attenuator probe could be used but the best solution for measuring low level high impedance signals may be to provide a special inlet socket for a cathode follower probe. This is yet another story.

If the oscilloscope is mounted on a shelf above the receiver being tested, a fairly short lead can be run between the input terminal and the test point and this, in fact, is what has to be done when using many commercial instruments.

Few reader will need detailed guidance on component ratings. It is a matter of opinion in some cases but we suggest that all resistors be 1 watt types except the three .47 meg grid return resistors, the 100 ohm stoppers and the resistors in the attenuator network. These may be ½ watt types. For the 10 meg resistor there would be an argument for using a 1 or 2 watt type in order to avoid voltage coefficient effects in the case of high level signals.

RATINGS

All capacitors which are subjected to high voltage during the warm up period should be rated at 600v working. The others may be of as low a voltage rating as can be obtained in the interests of compactness.

We have specified preferred values where components are most likely to be easiest to obtain in these values. Bias resistors, screen dropping resistors and, of course load resistors should be close to the values specified but some liberties are permissible with other values, provided you are clear as to the possible effects.

The circuit of Figure 4 was prepared with the idea of assisting readers who wish to build a new instrument as cheaply as possible or to completely rebuild an out-of-date oscilloscope. It

(Continued on Page 119)

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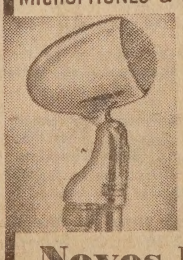

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ANSWERS TO CORRESPONDENTS

D.J.C. (Somersby, NSW) writes to comment on a recent Serviceman article in which an open circuit high stability resistor was the cause of some bother. He points out that he has used large numbers of these devices without trouble and suggests that failure is often due to users holding the body of the resistor with a pair of pliers while soldering, thus damaging the element.

A. Many thanks for you letter and comment, D.J.C., and we will pass your letter on to the Serviceman for his possible comment. However, we understand that there was no evidence of mishandling in the case mentioned. It is perfectly true that these devices are very reliable; a fact which makes the odd one which does fail all the more remarkable and most likely to puzzle a beginner who would not be expecting trouble of this kind.

D.A. (Tasmania) sends us a description of a vibrator power supply he has recently built to operate an electric shaver. He overcomes the problem of the higher frequency AC normally available from vibrators, and from which certain types of shavers will not work, by using a synchronous vibrator and providing DC. He also draws our attention to the recent invention by Russian engineers of an "electronic cow" and provides some essential details. His final comment concerns the cover of the May issue.

A. Many thanks for your letter, D.A., and helpful comments it contains. The shaver power supply is an interesting idea, though we are not sure that all types of shavers will operate from DC. However, we will file the article for possible future use in the "Reader Built It" column. Your comments regarding the Russian "electronic cow" are worth a laugh, and may find their way into a future Answer Tom article. In the meantime you may rest assured that the significance of the finer technical details have been fully appreciated by our technical staff. We were glad to hear that you liked the May cover.

W.A.L. (Lascelles, V.) wants us to provide complete constructional details for combining the 8 Valve Radiogram of 1955 with the "Multi-Band Tuning Unit" (Multi-Band Six, January, 1956?).

A. Sorry, W.A.L., but, as we have stated many times in these columns, we just cannot undertake jobs of this kind. The time required for such a reply would be equal to that required for a complete project for the magazine. Quite obviously we cannot afford this amount of time for any one reader. However, if you cared to substitute the "front end" (RF and Converter) of the Multi-Band Six for that of the Radiogram it would appear that a satisfactory combination would result. The main problems would be mechanical and we are afraid we would have to leave this one for you to work out yourself.

J.R.D. (Katoomba, NSW) inquires about scratch filters for gramophone pickups.

A. Record scratch may be due to a combination of the effects of poor record surface and needle resonance of the pickup. Systems to sharply attenuate the needle resonance band are of necessity relatively complicated and we take it that you probably would not be interested. Less ambitious filters are sometimes specified by pickup manufacturers and give partial relief. We do not have information on the pickup you mention and could only suggest that you write to the manufacturer or his agent in this country.

However, the "Basic Five" receiver is fitted with a top-cut tone control and this should give all the desired relief from scratch when in the maximum treble cut position. If the scratch is so bad that it is not attenuated by the control, the records and/or pickup would seem apparently to be so poor that there is not much hope of making a worthwhile improvement by filter circuits.

W.T.R.K. (Bendigo, V.) sends a subscription for 12 months and takes the opportunity to suggest that we produce a booklet containing all the Playmaster circuits and data to provide a quick and easy reference.

A. Many thanks for your subscription and this has been passed on to the appropriate department. It will commence with the March issue as there are no February issues available. We have noted your comments regarding the Playmaster series and we will keep this idea in mind. In fact it was something of the sort which we had in mind when we contemplated an amplifier handbook. This has had to be shelved for the present, but we may be able to consider it again in the near future. Odd copies of back issues are available and we suggest you write listing those you require and we will endeavor to locate them for you.

T.R.M. (Bulimba, Q.) sends us a circuit of a set which he has recently completed and which is giving very good results. Main feature of the set is the TRF tuner and the use of an 807 output valve, plus the fact that most of the parts came out of the junk box and the set was built for very little outlay. T.R.M. also tells of other projects he has undertaken, mostly Radio, TV and Hobbies circuits which have been very successful. He goes on to comment on the pleasure he has received from the magazine and to emphasise that he is a very satisfied reader.

A. Many thanks for your letter, and the circuit you enclose. We w the letter for possible use in the Built It" section at some future date. are glad to learn of your successful from the magazine and the pleasure yo derived from it. We will do our b maintain and improve this standard a hope it will continue to prove helpf interesting.

"Judo" (Christchurch, NZ) Wishes t nect a pickup and/or a microphone to ceiver with a valve lineup of a 6A7, 6B7, 42 and 80.

A. Without knowing the circuitry of ceiver you have, it is difficult to set procedure for installing a pickup. H the requirement is that the pickup be fed into the audio section of the your case, if it is a conventional circuit ment, the detected audio output from th section would feed into the grid of th controlled by a potentiometer (or volum trol). The pickup could be connected the "hot" end of the volume contr earth, via suitable terminals. All e leads should be of shielded wire to gi hum pickup. A two-position switch shou be connected into the circuit to "brea audio lead from the tuner section to t end of the volume control when playing A microphone will need to feed into amplifying stage delivering its output in same point as normally used for the

R.G.D. (Christchurch, NZ) is interes building a battery portable that coul be used from the AC mains, and incorp a rod aerial. He would like to know a plastic cabinet is obtainable for such

A. The Jubilee Portable, which was in the December, 1951, issue, should me requirements, with the exception of t aerial. However, a rod aerial may b stituted for the loop aerial specified. knowledge plastic cabinets have not been available to suit R, TV & H designs.

D.B. (Lakemba, NSW) has an 11 valv mercial receiver from which one of the wave coils has been taken and replaced different type. He would like to obta of the original type.

A. Sorry, D.B., you do not give th of your receiver but we suspect that t very old type and that you are unlikely able to buy the coil you require. A co radio technician should, however, be a substitute a suitable coil and realign t ceiver to give the same results as the

J.H.A. (Nedlands, WA) forwards the of an amplifier which he feels may interest to other readers.

A. Many thanks, J.H.A., your circuit to represent an interesting and well o approach to the problem and we m able to make use of it in a future Built It" feature.

G.A.K. (Burwood, Vic.) describes perience with a very old three valve which he recently overhauled and pu service.

A. Your letter was read with intere we will pass it on to our Servicema will no doubt enjoy it, having had experiences himself. Before replacing valves we would suggest that you have tested. It is possible that one of the be below par but we have often enco very old valves which tested right up original specifications.

R.D.C. (Mundalla, SA) encloses a subscription and, at the same time, m his experiences with small receivers. the "De-Luxe Crystal Set" he has been to get low but intelligible volume f station 95 miles away.

A. That certainly is a very good p ance, R.D.C., because, as a general r feel that 15 miles or perhaps 20 miles case of some of the higher-powered is about all that could be expected. It easy to offer a solution to your proble the battery receiver. If it is oscillatin timuously at audio frequency it could to the leads from the output stage of being brought near the detector grid. other hand, a radio frequency oscilla would cause whistles as you tune o stations) could be due to an unsuitat choke. The most suitable RF chokes type of receiver have multi-section pie ings. Our thanks for the subscription.

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Picture Tubes

(Continued from page 9)

brings us quite naturally to the everybody asks: how long will it? I asked AWV engineers on and they told me that users normally obtained from our years from a picture tube. hey hastened to point out that use their sets for many more day than we will be able to st for a long time. o run their screens at a higher han we are likely to use, due ner picture repetition rate and lower flicker. We should expect rather better than the our years quoted. n you finally buy your picture r in a set or separately, you ssured that you will be getting for your money. You will be ny thousands of hours of top ture performance.

AMPLIFIER

(Continued from Page 117)

ied to use the components of CRO design.

rizontal amplifier has ample cept the output of the gas e base and in our particular upper frequency response is n at about 120 Kc, which is gh to reproduce a 7 Kc or a tooth wave with reasonably tion. There is a reserve of abling the pattern to exceed width if desired.

that we have omitted the circuit used in an earlier O. The space it would otherpy is better devoted to the amplifiers.)

ions betwen the panel terl the deflector plates are direct viously we specified coupling Advantages of this are that equency response is improved lower coupling reactance and frequency response due to the ay capacitance.

L CAPACITORS

mean, however, that external capacitors will be needed if, ple, you wish to connect an ng loop to the deflector plate and still retain the use of the ols.

e same reason the coupling in the output circuit of the base oscillator has been omitexternal capacitor will be you wish to feed the oscillator cuit without a blocking capaicumstances where external capacitors are required are in-

ernal resistance of the circuits that there is no more danger than from the AC components nal which are present on the in any case.

l terminals which are normally together are shown on the ined by broken lines.

more need be said about the cept to mention that cathodetype VCR97 is an excellent ich may be used in place of . Users have reported a consistently finer trace with the VCR97 than with the 5BP1 for the same operating voltages and it can be used with up to 2500 volts if desired.

The heater is rated at 4.0 volts and 1.0 amp so that a dropping resistor will be required with the standard 6.3 volt filament winding. The screen diameter is 6in but the length is about the same as the 5BP1 and it can be fitted into our standard case without difficulty.

The VCR97 is also available cheaply from disposals sources.

REFERENCES

Readers who wish to study the subject further may find the following list helpful. Most of the books mentioned contain further references.

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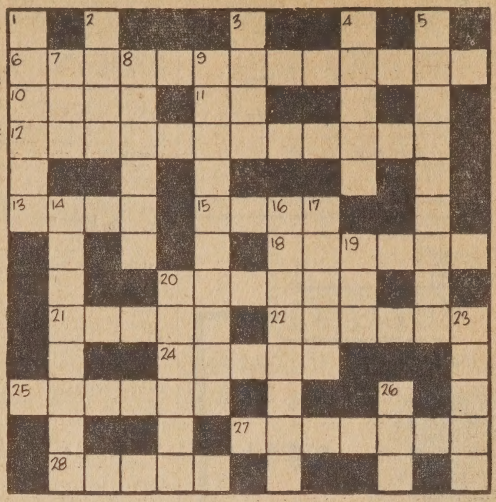

ACROSS

6. Having frequencies between zero and 10,000 Mc (2 words).
10. Assert.
11. Note well (abbrev.).
12. Checking meteorological conditions with radio balloons (two words).
13. Typical Englishman's exclamation.
15. In which power is dissipated
18. Characteristics.
20. Interfering signal of natural origin.
21. One of the Marx Brothers.
22. Reply.
24. Songs in an opera.
25. Commands
27. Resist or reducing HF potentials on grid.
28. Thick.

DOWN

1. To make alive.
2. To be reared.
3. Island off NE coast of Victoria.
4. Radio location.
5. Converts mechanical into electrical energy.
7. Girl's name.
8. Three-element valve.
9. Offer high resistance to flow of current (p1).
14. Brought together.
16. Draws towards.
17. To remove moisture.
19. Decree.
20. Discharges in air.
23. Large city in Cornwall.
26. Medicinal spring.

Solution and further crossword next month

H	A	R	M	O	N	I	C	S		S	O	
A		E		R		D	A	M	P	I	N	G
N	O	M	O	G	R	A	M		O	L	L	A
D	U	O		I			S	T	R	A	Y	S
C	I	T	I	E	S		H	A	T	S		
A		E		S	A	H	A	R	A			F
P	I	C	K				F		G	A		A
A		O	N		B	U	T	T	E	R	E	D
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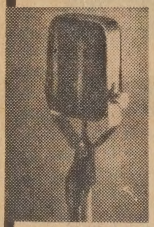

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